The Electrical Industry's Weekly Magazine

June 24, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

25th ANNUAL CONVENTION

EEI Sees "Power-full" Future

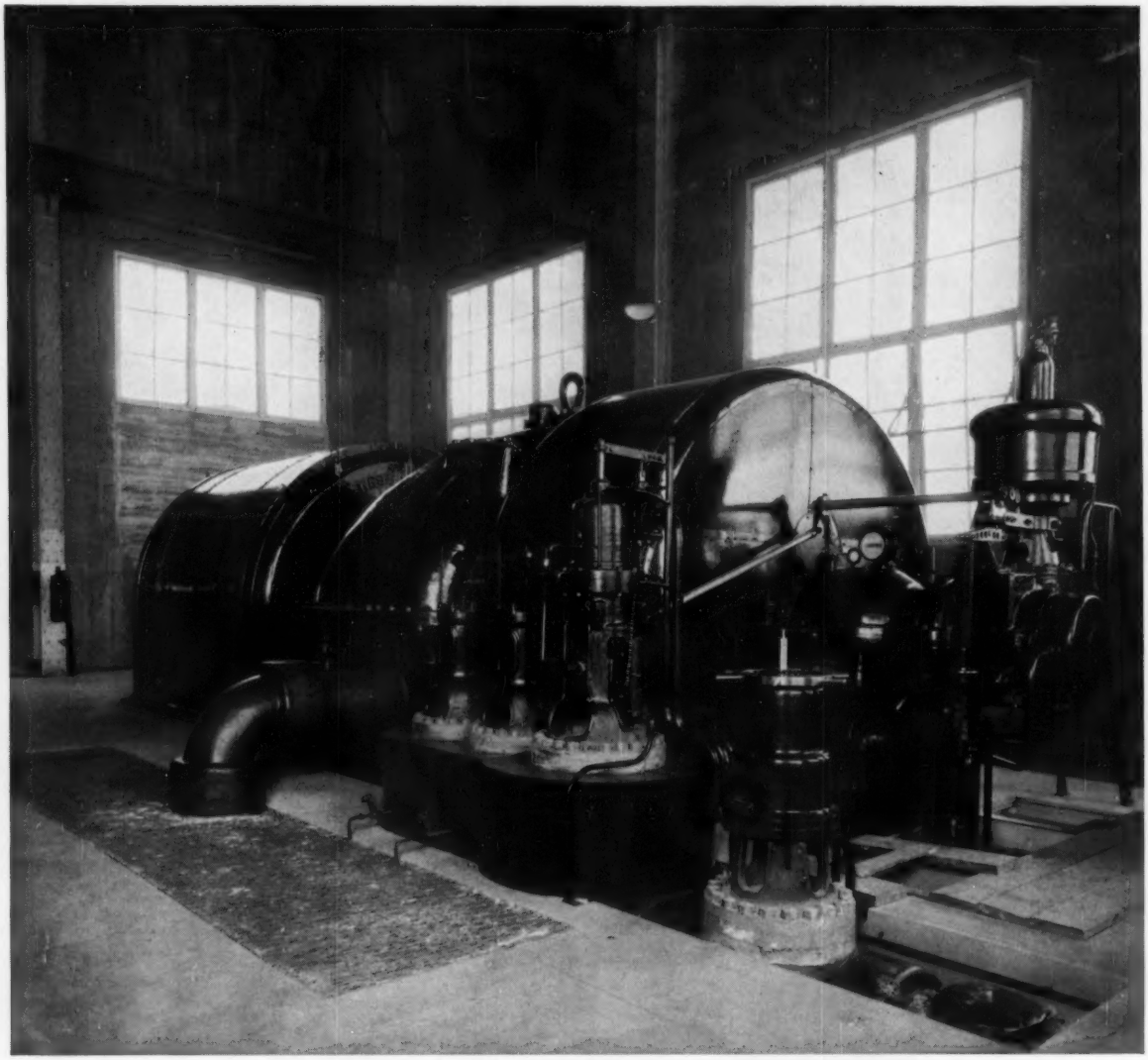
. . . Page 97

Special Report Includes Exclusive Interviews with

Pres Donald S Kennedy . . . Page 98

Vice Pres J Wesley McAfee . . . Page 99

A-Plant Needs Reliable Power...p 94



This turbine has been Texaco-lubricated for 26 years . . . is still on original bearings.

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If you're like most turbine operators, you want an oil with an extra margin of safety built in.

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FOR ALL TURBINES

Electrical World

Vol. 147, No. 25 JUNE 24, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

If a Heat Storm Comes . . .

Utilities that bore brunt in 1954 heat wave say they're ready. Air conditioner sales up.....p 82

GENERATION

A-Plant Needs Reliable Power

Auxiliaries, especially coolant pumping system, must obviate some types of interruptions.....p 94

SUBSTATIONS

Arresters Prevent Equipment Failures

Proper application key to performance; failure probabilities weighted against equipment's.....p 90

Special Report

A "Power-full" Future—EEI Theme

Federal power issue dominates speeches at 25th annual meeting; Kennedy, McAfee interviewed.....p 97

Departments

Atomic Progress 85
Books 144
Catalogs and Bulletins.....146
Editorials 81
• Electrical Newsletter 19
From the Publisher..... 5
How To 116
• Management Newsletter 207
Manufacturers and Markets.....191
Meetings Calendar 224
Meetings Reports 89
New Equipment 134
News About People.....215
News-Beat 88
Selling 128
Technical Literature 146
Washington Wire 84

INDEX TO ADVERTISERS.....229

Miami Seaquarium plans ahead electrically

Farsighted engineers for the new $2,300,000 Seaquarium in Miami specified 5kv Keystone-insulated feeder cables although initial voltage was only 220 volts. More than 2 miles of Keystone cable, buried directly in the sand, supply power to pumps, filter plant, underwater floodlights, P.A. systems, refrigerated fish-food vaults, and other modern conveniences that make conditions more pleasant for both man and fish. These 5kv feeders provide an excellent way of handling future increased load requirements by merely raising the distribution voltage.

These same engineers chose Keystone-insulated Armortite cable because it met their high standards for moisture resistance, high dielectric strength, continuous operation at high copper temperatures, and a tough outer sheath for direct burial that would be impervious to attack from corrosive salt-water seepage.

This is just one example of how Keystone-insulated cables provide dependable and economic power distribution. For more information on specific cables or for engineering assistance in selecting the right cable for your job . . . contact your nearest Okonite representative or The Okonite Company, Passaic, N. J.

where there's electrical power . . . there's **OKONITE CABLE**

4189

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. . . *from the publisher*

We thought we had covered all bases in our recent case for reading Electrical World at home (EW, April 1, p 5). But from one of our longtime Canadian subscribers come more valid arguments.

Writes Professional Engineer R. E. Jones from Bolton, Ontario: "Since first subscribing about 1913 my Electrical World has been delivered to my home. Advantages are so obvious:

- At home there is time for concentrated reading (I did not say uninterrupted).
- Nobody at home is interested enough to walk off with your copy."

After he clipped items of interest it was reader Jones' practice to take his copy to work with him. Now retired, he still reads EW, still does his odd clipping. But he has a problem. What to do with his clipped copies now that he no longer goes to the office?

"There is an obvious answer," he says, "but imagine what my house would be like if I had retained all the copies for the past 44 years."

Fischer Black

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An example of Allis-Chalmers leadership

They Whisper While They Work!

These two 100,000-kva Allis-Chalmers transformers are good neighbors... thanks to careful pre-planning.

Installed in the middle of a residential area, these two large transformers could have created a public relations headache.

They didn't . . . because of elaborate planning by the utility's engineers working together with A-C.

In fact, this installation is a model of what can be done.

Before any designing was started, Allis-Chalmers mobile sound laboratory equipment was brought in. Day and nighttime studies of ambient characteristics indicated that the most economical solution to the problem required a twofold attack.

1. Design and build a low noise level transformer unit with frequencies melded to the ambient.

2. Build a masonry barrier around the transformers to reduce the noise level further.

So critical were the conditions that neither step by itself would do the job.

Today, the transformers are in full operation . . . and there are no complaints from the neighbors.

Transformers like this are an outgrowth of continued research by Allis-Chalmers into magnetostriction and resonance in A-C sound laboratories, acoustical proving ground and mobile research unit.

* * *

For help in finding the best and most economical means for solving sound problems, contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

This was the area with residences as close as 170 feet from the proposed transformer locations.

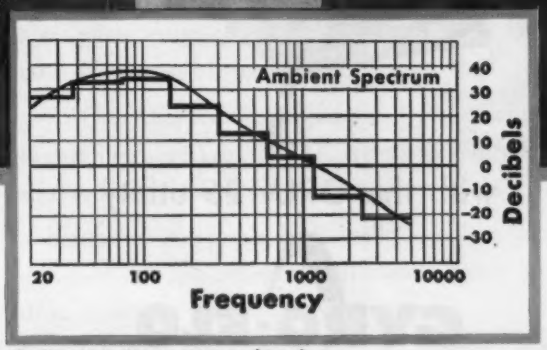
Mobile sound testing equipment was brought in to study ambient characteristics and find a noise level that would not be objectionable.

A-C ALLIS-CHALMERS

ALLIS-

A-5353

in power transformers



On-the-site testing in quiet predawn hours determined minimum masking noises.

Transformer noise level lower than standard and use of masonry barriers were dictated by the severe requirements of the neighborhood.

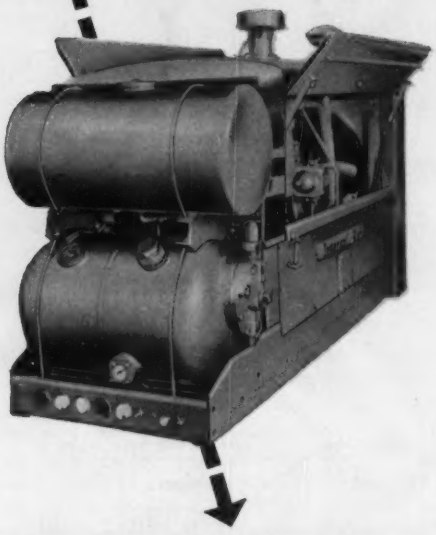
CHALMERS

ROOM to spare POWER to spare

Here's a rotary air compressor that's so small and compact you can mount it in a Utility truck and still have plenty of room for men and equipment. And with a full 125 cfm capacity, you have plenty of air power for all normal digging, demolition and tamping jobs, too.

The Ingersoll-Rand GRU-125 GYRO-FLO compressor occupies only 70 cubic feet of space and weighs only 2000 pounds. Designed especially for truck mounting, this completely self-contained, self-powered unit can be located crosswise behind the cab, taking up only 31" of truck length and 46½" of the height. The control panel, for ease of operation, is mounted below the receiver at the curb side of the truck.

What's more, the GRU-125 has proven itself in over three years of service with utility companies all over the country. It also offers all the *service-proved advantages* of the famous GYRO-FLO portable rotary compressor. No pistons, rods, valves or clutch to wear out or adjust; discharge temperatures less than 200F; low oil consumption and smooth, vibration-free operation. *Yes, there's only one* GYRO-FLO—Ingersoll-Rand's rotary portable compressor. It will pay you to ask your I-R representative for complete details.



with the GRU-125 utility

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for Truck Mounting

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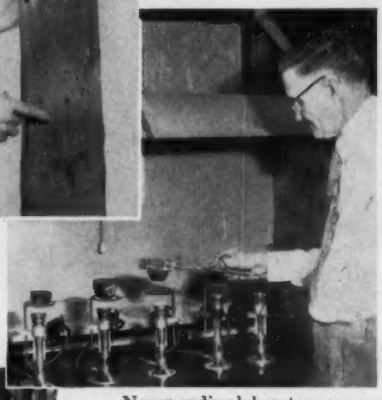
"LIFE-SPAN"

WESTERN RED CEDAR POLES

. . . the result of constant research

Scientific leadership pays off! Here J. D. Burnes, nationally known in wood preservation work for over forty years, points to the ground-line area of another sound LIFE-SPAN Pole after sixteen years' service life. Note the "like new" appearance. Result: No deterioration from top to butt, pole maintenance and replacement costs have reached an all-time low for users of LIFE-SPAN Poles!



LONGER POLE-LINE SERVICE . . . LOWER MAINTENANCE and REPLACEMENT COSTS

Never-ending laboratory research together with constant plant improvement at Page & Hill mean better treating controls. Result: Maximum penetration and retention, greater uniformity.

Page & Hill maintain test plots with poles in line under severe conditions. Since 1941, *not one* LIFE-SPAN pole has shown any sign of deterioration. Result: LIFE-SPAN far exceeds every expectation—proof of LIFE-SPAN'S superiority.

***When you buy . . .* SPECIFY**

"LIFE-SPAN"

WESTERN RED CEDAR POLES

BUILT BY NATURE

Life Span

PAGE & HILL, INC.

MINNEAPOLIS 3, MINNESOTA

R&IE AIR SWITCHES

have ALL *dimensions . . .*

DEPTH
WIDTH
HEIGHT
LENGTH

An installation of the original 1910 horn gap switch, as designed by R&IE

No. 1—DEPTH *of Experience*

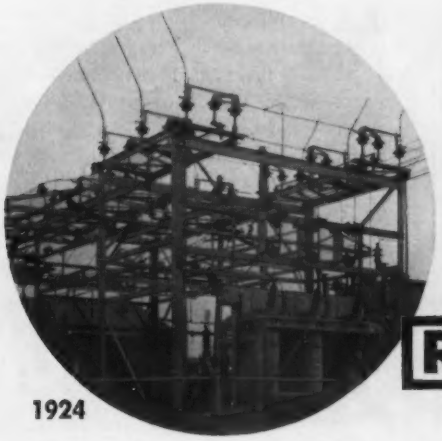
BACKGROUND—that's what the founders of R&IE—and those who followed gave to modern switch design. They learned, through long-time field experience, the elements of switch design that have lasting value, also those that cause operating troubles.

The original horn-gap "Burke" switch in 1910, followed by the original hi-pressure contact, the first rotating blade, and the first sealed hinge contact, are examples of R&IE contributions.

It's this 47 years of experience that pays off in long service life of every R&IE switch, and with ingenuous answers to switch application problems.

SPECIFY THE "EXPERIENCED" SWITCH!

Now note our progress . . .

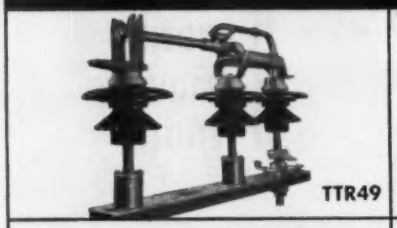


1924

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

R&IE AIR SWITCHES

GROUP OPERATED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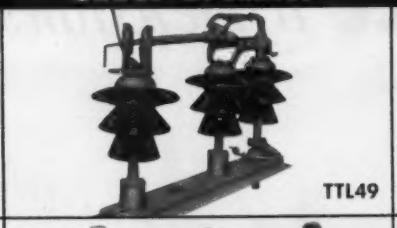
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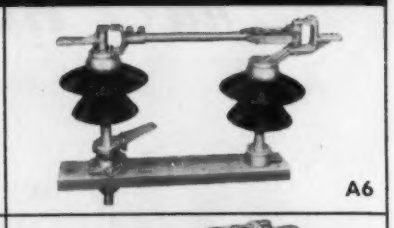
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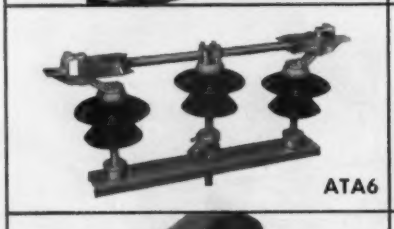
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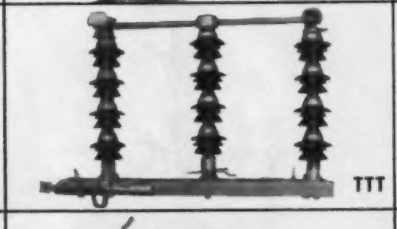
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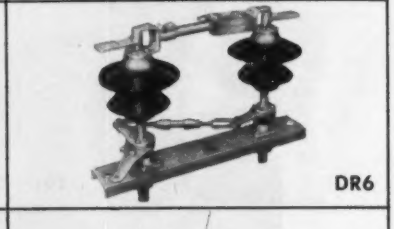
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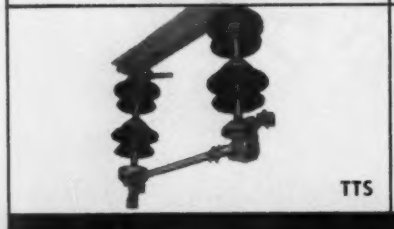
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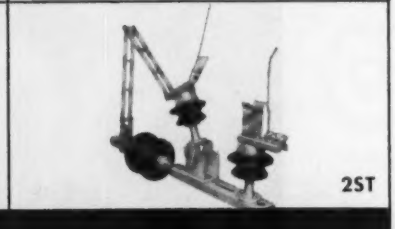
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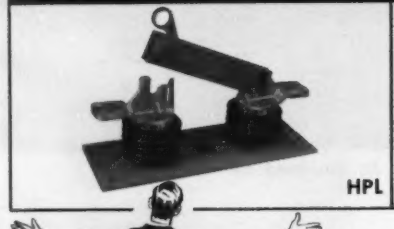
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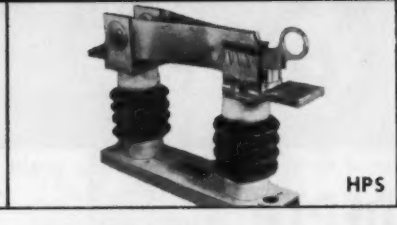
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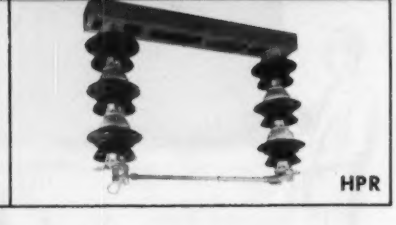
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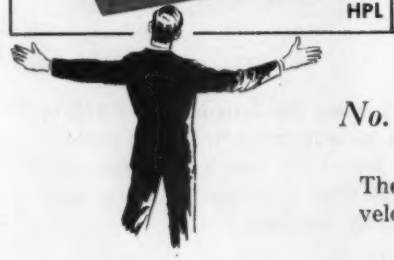


No. 2—WIDTH *of Selection*

The great variety of R&IE switch types is the width dimension developed by constant evolution to meet new switching requirements.

TTR49—vertical break
TTL49—vertical break (horn-gap)
A6—side break, toggle jaw
ATA6—double side break, toggle jaw
TTT—double side break, rotating blade
DR6—center break
TTS—side break, rotating blade
3ST—3-insulator, braidless,tilting
2ST—2-insulator, braidless,tilting

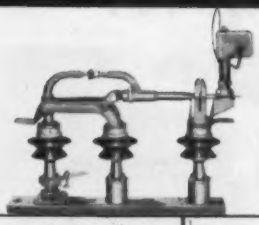
TRE—vertical break, load interrupter
AE—side break, load interrupter
3STE—tilting, load interrupter
TR1—quick break arcing horn
ALTO—tap-off, quick break arcing horn
TRG—air-blast interrupter
HPL-C—arc chute interrupter
L—internal arcing interrupter
ELBD—single phase interrupter

HPL—line contact, 3" bolt circle
HPS—spot contact, 3" bolt circle
HPR—special spot contact and latch, 5" bolt circle

TG—manual, grounding
TGV—high speed, vertical
TGH—high speed, side, grounding

have **ALL** *dimensions . . .*

INTERRUPTING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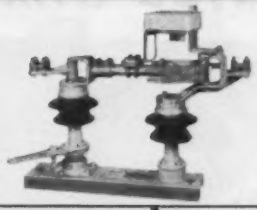
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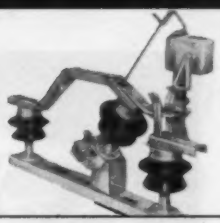
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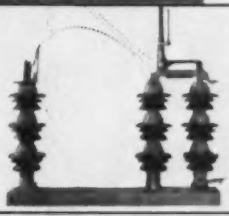
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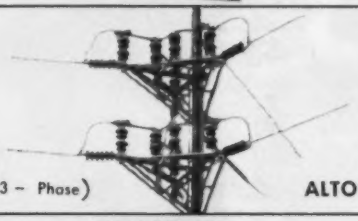
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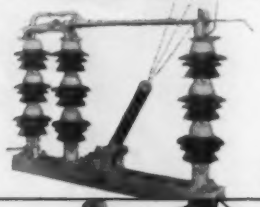
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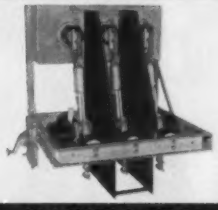
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ELBD

GROUNDING—MANUAL AND AUTOMATIC

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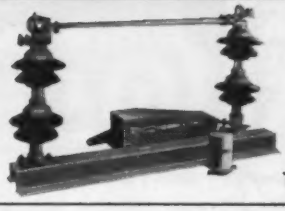
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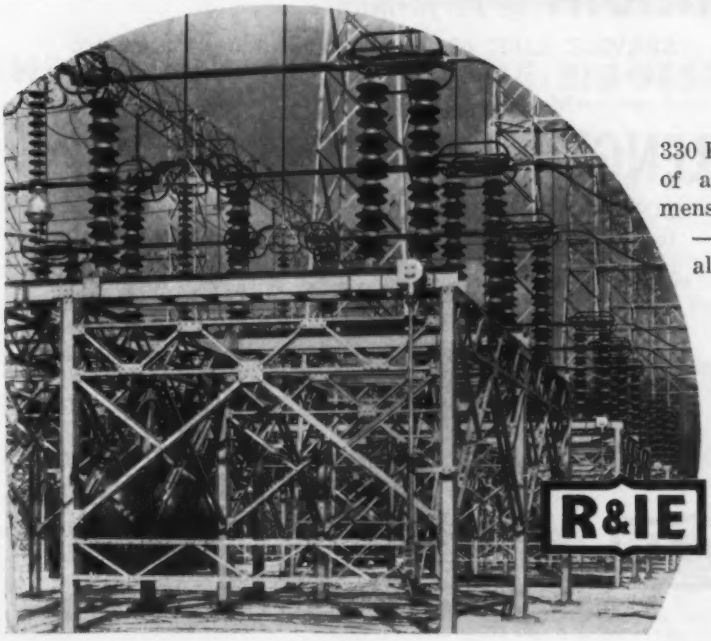
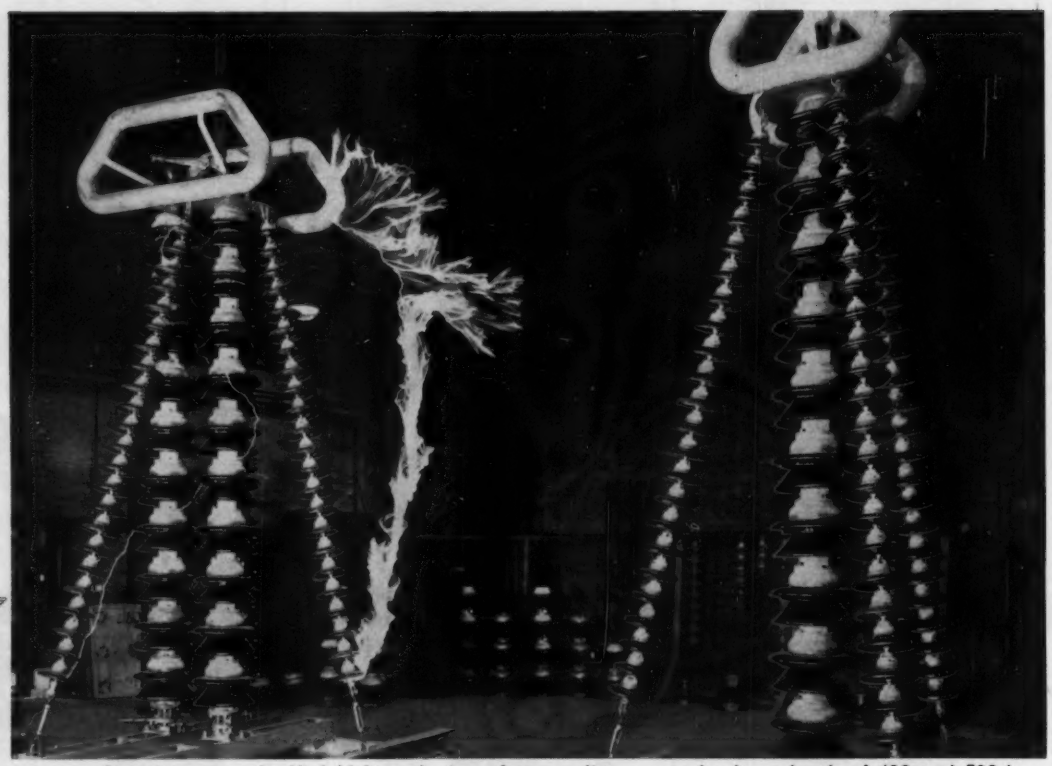


330 Kv switches are indicative of another R&IE width dimension—full voltage range —7500 volts and all the way up.

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

R&IE AIR SWITCHES

have **ALL** *dimensions . . .*



Searching, over the High Voltage horizon, for gap distances and voltage levels of 400 and 500 kv.

No. 3—**HEIGHT** *of Performance*

SERVICE LIFE of R&IE Air Switches is a third dimension on which you can base your confidence. Your confidence is our constant goal.

Modern R&IE Research and Test Laboratory

No. 4—**LENGTH** *of Research Programs*

LONG RANGE DEVELOPMENT programs continue to search for new devices and new economies. Constant improvement in switch details, and switching applications, is the kind of "vision-eering" that reaches for your problems of tomorrow. Call on your I-T-E representative for technical assistance. He has the command of both experience and specialized service to help you solve those problems.

The Margin of Quality Distinguishes R&IE Products

R&IE

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

Hotpoint Electric Ranges

women-tested features that build sales...load...revenue!

- "Fashion-Front" Styling
- Colortones
- Color-Lighted Pushbuttons
- Two-Way Super-Matic—Choice of 6″ or 8″ Unit
- Automatic Time Control of All Surface Units
- Musical Meat Thermometer
- 1½ Gallon Coffee-Perk
- Super Fast "Super 2600" Calrod® Unit • Silver Grey Ovens
- All-Calrod—Surface *and* Oven
- Rota-Grill Rotisserie
- Handi-Over Grill
- Handi-Raise Broiler
- Golden Griddle • Thrift Cooker
- Automatic Reset Oven Timer

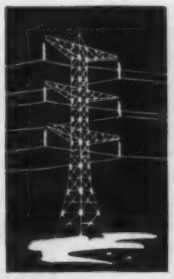
HELPING YOU SHAPE THE BIGGEST TOMORROW...EVER!

Here's the Electric Range that puts more *salespower* behind "HOUSEPOWER," more *living* in "LIVE BETTER . . . Electrically"! That's because Hotpoint made hundreds of studies to determine what your women customers want in an electric range—then designed models and features to specifically meet those demands!

Let Hotpoint Automatic Electric Ranges help you shape the biggest tomorrow—*ever!* Hotpoint's women-tested features offer the shortest distance between the sales floor and more electric ranges on your lines. And, when Hotpoint's hard-hitting national advertising and imaginative sales-promotion are tied-in with the "HOUSEPOWER" and "L.B.E." programs, you can boost your electric range sales, load and revenue to more profitable levels.

Have your Hotpoint Distributor show you the *complete* Hotpoint Range Line for '57 . . . 6 NEW 39-inch models and 3 NEW 30-inch models!

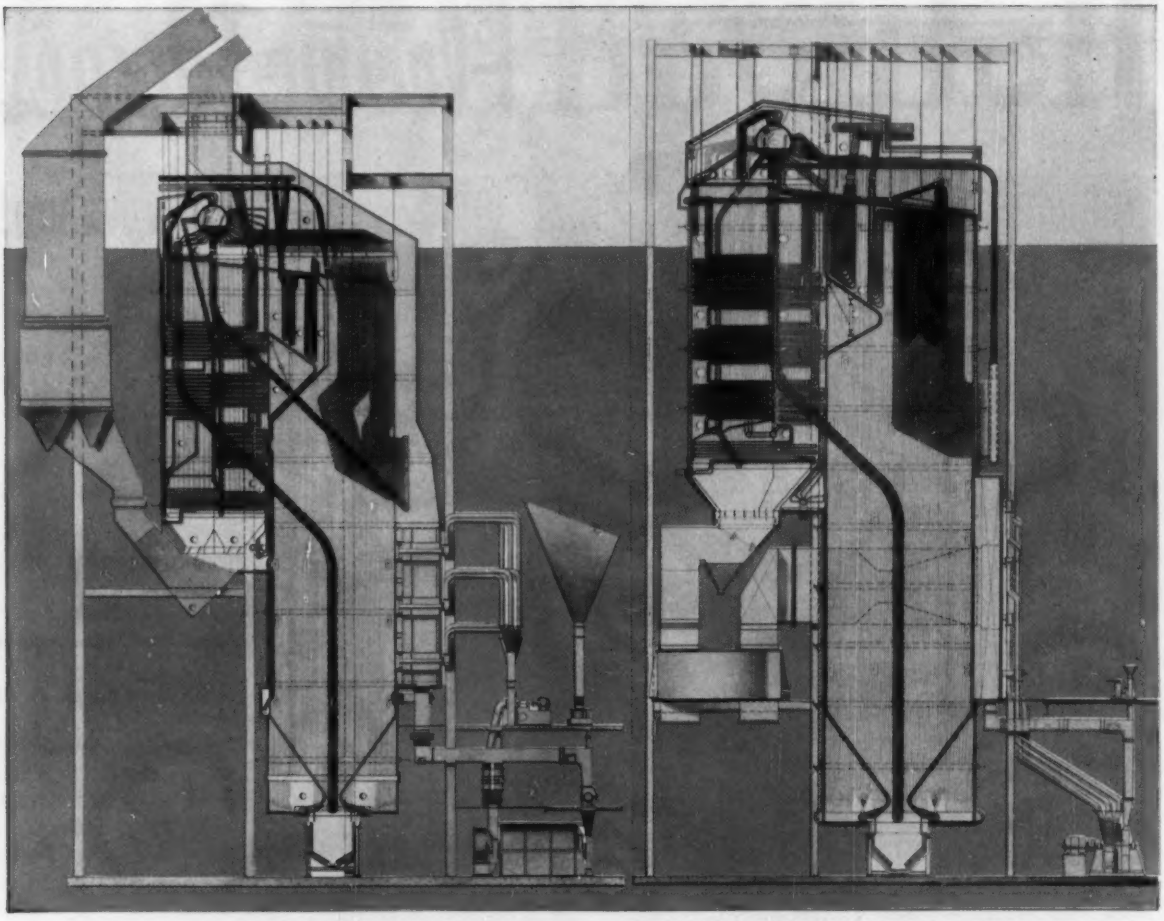
Again, Hotpoint



LIVE BETTER ELECTRICALLY

looks at Tomorrow, Today!

HOTPOINT CO. *(A Division of General Electric Company)* ***5600 Taylor Street, Chicago 44, Illinois***



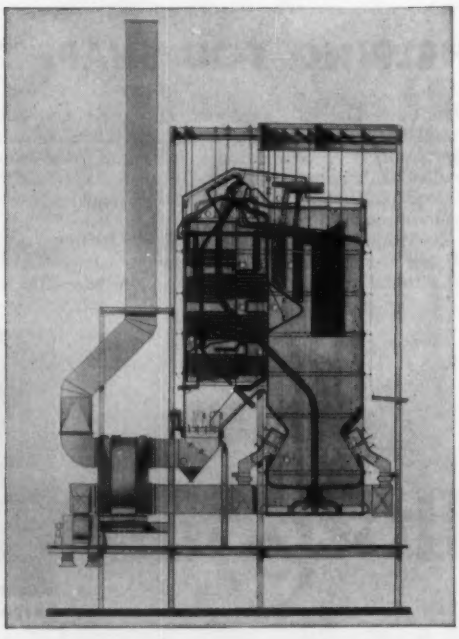
Public Service Co. of Indiana, Inc. — New Albany
Two Units — 1,000,000 lbs/hr; 2075 psig; 1005/1005 F
Sargent & Lundy, Consulting Engineers

The Hartford Electric Light Co. — Middletown, Conn.
800,000 lbs/hr; 2100 psig; 1005/1005 F
Stone & Webster Engineering Corp., Consulting Engineers

The RILEY TURBO FURNACE

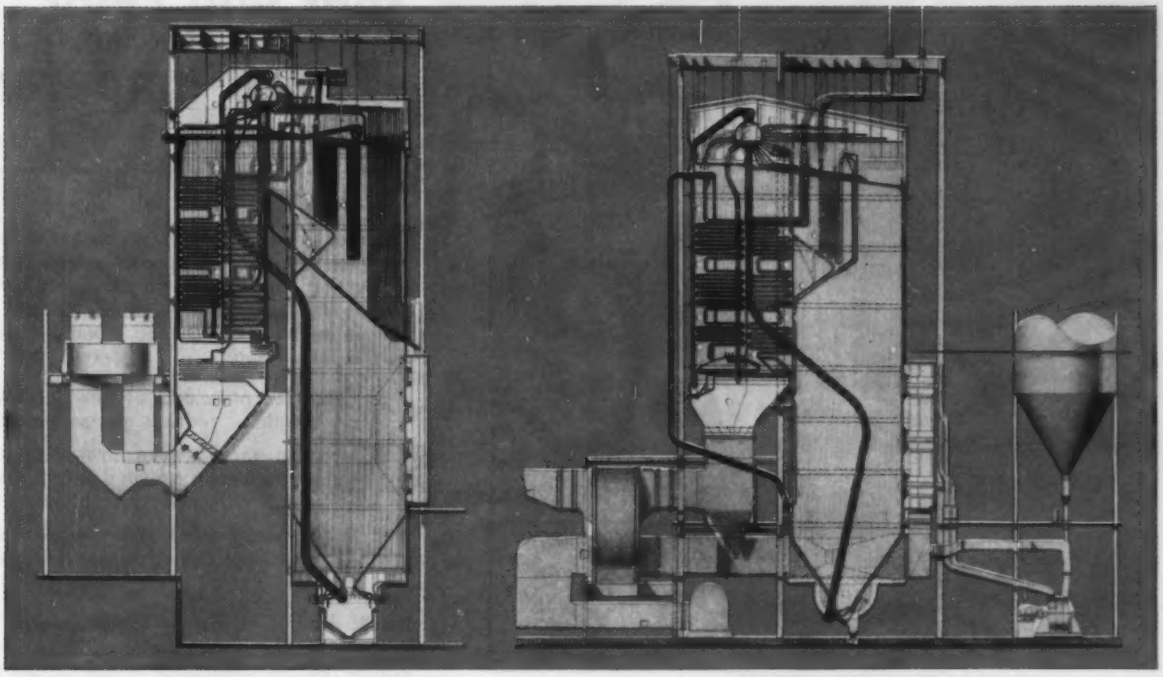
the design of the future that's HERE!

Since late 1955, when this design was first announced, 19 Riley TURBO FURNACE boilers in capacities from 150,000 to 1,600,000 lbs/hr have been sold, eight of them to public utilities. This rapid acceptance is a result of the TURBO FURNACE'S exceptional performance characteristics and its ability to utilize multiple fuels. Users, burning oil or gas initially, can switch to solid fuels in the future without the costly delay caused by conversion of furnace and heating surfaces. A wide range of coal, lignite or other solid fuels can be burned; with fly ash reinjection in the furnace unburned losses are negligible. In addition, the Riley TURBO FURNACE boiler has all burners on one level with a consequent reduction in overall height.



Current RILEY Reheat Designs

PULVERIZED COAL FIRED



Central Illinois Light Company — R. S. Wallace Station
690,000 lbs/hr; 1650 psig; 1000/1000 F
Commonwealth Associates, Inc., Consulting Engineers

Minnesota Power & Light Co. — Clay Boswell Station, Duluth
Two Units — 500,000 lbs/hr; 1725 psig; 1005/1005 F
Ebasco Services, Inc., Consulting Engineers

The use by public utilities of Riley Reheat Units for all capacities and steam conditions has climbed rapidly and steadily during the past decade. This gratifying acceptance is the result of the record of performance, dependability and continuity of operation established by Riley units.

The designs illustrated on these pages are typical of those currently being supplied for pulverized coal firing. They are just a few of many Riley central station designs. Let our sales engineers show you others.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver (Englewood), Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

A SINGLE-VENTED

open cutout

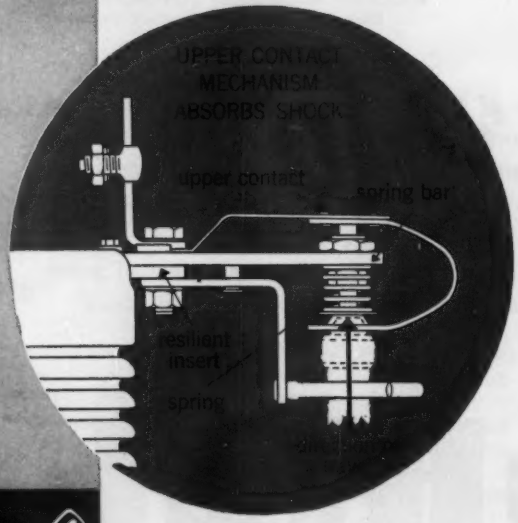
that will clear 12,000 amperes!

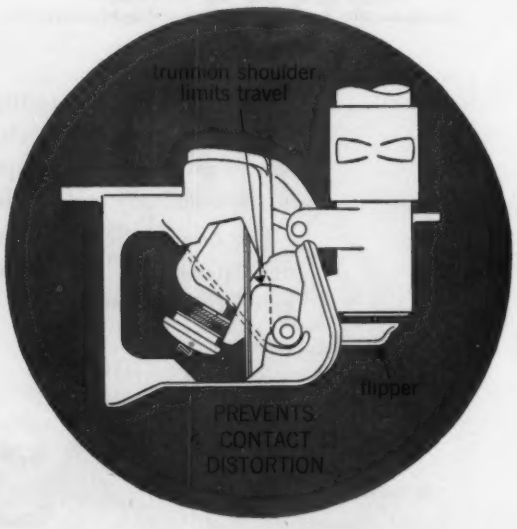
Type XS

Significant new* developments by S&C now take the open cutout to exceptionally high levels of interrupting capacity without sacrificing low fault current interruption ability, without added cost, without double venting, and without disregard for linemen's safety.

- ✻ Controlled placement of fuse link shortens arc length — reduces gas generation.
- ✻ Multistep recoil action (from recoil bar, spring, resiliently mounted insert, contact) absorbs energy when fuse blows.
- ✻ Supplemental recoil action, when trunnion engages hinge casting, dissipates remaining energy.

The XS may be closed on 12,000 ampere faults (7.5 kv rating). And the patented "flipper" feature assures reliable interruption of low-current faults.





S&C

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS • U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶ **At least one large metropolitan utility is actively investigating possible use of high voltage dc transmission** for linking generating stations where rights-of-way are tight.

Here's a date for your future calendar. National Electrical Week will be celebrated Feb. 9-15 next year—the week in which Thomas A. Edison's birthday anniversary falls.

Advanced-type, room-sized heat pump is undergoing tests. It's reported to contain many refinements over the unit now being used in motels. Marketing plans haven't jelled yet.

Will high interest rates encourage creation of more generating companies? This would enable utilities to finance such enterprises with a high funded debt and a low amount of equity.

LATE NEWS ▶ **Four utilities hit by heat waves report new peak loads** which top previous winter peaks. They are Consolidated Edison, Potomac Electric Power, Philadelphia Electric, and Union Electric. For Con Ed, it was a "first." Pacific G&E also peaked for this year so far, but last summer's peak, on June 28, remains the higher load.

Price increases, ranging from 5 to 10% in four turbine lines, are announced by General Electric's Turbine Division, effective July 1. Price of large and medium steam turbine generator units will go up 5%; mechanical drive turbines, including boiler feed pump turbines 5%; and gas turbines 10%. Hike would boost book price of 150 Mw 2,000 psig 1050/1000 F tandem-compound unit from $4,861,800 to about $5,105,000.

Florida PUC orders Florida P&L and Gulf Power to trim rates to bring earnings down to 6.5% or face public hearings in late summer to show why rates should not be cut. FP&L Chairman McGregor Smith says FP&L, with 7.2% return now, is short about $30 million in reserve generating capacity. If reserve had been built as fast as power sales increased, return would have been 6.5%.

President Eisenhower, in surprise move, nominates two Truman Administration officials to AEC. They are John F. Floberg and John S. Graham, who would replace Thomas Murray on expiration of his term June 30, and the late Dr. John von Neumann.

ODM Chief Gordon Gray refuses to turn over to Sen Estes Kefauver's antitrust and monopoly subcommittee a memo written by his predecessor Arthur Flemming dealing with Idaho Power amortization tax certificates (see p 84). Gray said document was "executive privilege." Kefauver contends Flemming opposed the write-off.

Congratulations . . . Interstate Power Pres M. L. Kapp is elected president of recently formed Central Utilities Atomic Power Associates. VP's are utility heads Allen S. King, Northern States Power; C. A. Semrad, St. Joseph L&P; and C. G. Wright, Otter Tail Power . . . Probable 1957-58 president of AIEE will be Walter J. Barrett.

ELECTRICAL WEEK

A TWO-MINUTE

EEI REPORT ▶ **Some 1,400 utility executives turned out for the 25th annual convention** of the Edison Electric Institute held in Chicago earlier this month. From the platform and through corridor conversations, many of them heard pleas for electric companies to speak out against their critics and to foster broader public understanding of the power business. Our comprehensive report on the EEI proceedings features exclusive interviews with the two men reelected to lead the organization for another year—Pres Donald S. Kennedy and Vice Pres J. Wesley McAfee. The 16-page report begins on **page 97.**

EVENTS ▶ **Heat storms hit again.** Consolidated Edison curtails power use in New York as city swelters in above 90F heat . . . Philadelphia Electric hits new record peak . . . But utilities which suffered in the heat wave of 1954 are all set for anything that may come along **(p 82)** . . . Nuclear Power Group starts construction on giant Dresden plant near Chicago **(p 85).**

WASHINGTON ▶ **Hearings continue on rapid tax amortization phase** of the Hells Canyon power project **(p 84).**

GENERATION ▶ **Highly reliable auxiliary power is a must for nuclear plants.** Because of lack of operating experience, you can expect the same conservative engineering design in auxiliary system as in the reactor part of the plant. Added to that are some peculiar operating characteristics of nuclear plants that require special auxiliary power supplies. Among these are increased pumping requirements, and especially the necessity for shutdown cooling. For even after the nuclear firebox has been doused with insertion of control rods, it still produces shutdown heat running 1 to 10% of operations level for some time afterward. Dissipation of this shutdown heat is the main problem dealt with in the article by two Westinghouse engineers **(p 94).**

TRANSMISSION ▶ **Soil injections of herbicide kills trees up to 8 in.** in diameter. It promises to be a low-cost, effective technique for clearing utility right-of-way. Professor Wayne G. McCully of Texas A&M tells of test results **(p 120).**

DISTRIBUTION ▶ **Vacuum oven cuts time for drying power transformer cores** to less than ⅓ of that required by the old atmospheric-pressure oven. The oven being used at Georgia Power's general repair shop is constructed of ½-in. steel plate. Heat is applied for 60 hrs to obtain uniform temperatures throughout the core. Then the vacuum is applied for a 24-hr period. Oil immersion is completed before the vacuum is broken **(p 122).**

COMMUNICATIONS ▶ **Compact grid-dip oscillator has been designed for tuning line traps** on Appalachian Electric Power Co's carrier communications system. The device requires no ac power source. Sensitivity of the indicator

has been found excellent and unaffected by the diode shunting the meter. Wiring diagram and photo are a part of the article (p 116).

SUBSTATIONS ▶ **Effective lightning arrester application** is guided by three basic rules, writes Staff Engineer H. R. Armstrong, Detroit Edison, in a comprehensive discussion of arrester application. The rules are: (1) Determine the proper arrester voltage rating. (2) Determine the strength of the insulation to be protected. (3) Match the protective ability of the arrester to the insulation (p 90).

SELLING ▶ **Small electric fences ward off mice and rats from the grain bins** at Pacific International Rice Mills plant in Stockton, Calif. An ordinary electric fence unit supplies 2,000 v at 16 ma from a 15-v outlet . . . Well-planned fluorescent lighting system increases production at a Connecticut printing plant (p 132).

MANAGEMENT ▶ **California Attorney General argues that tax deferment benefits should be passed** on to ratepayers rather than retained in utility reserve accounts . . . A Nevada County levies property taxes on power facilities at Hoover dam . . . Some electric companies postpone financing plans in hopes of more favorable money market (pp 209, 210) . . . Outlook for appliance manufacturers remains bleak with heavy stocks of the old standbys: ranges, dryers, washers, vacuum cleaners (p 207).

PEOPLE ▶ **At Superior Water, Light & Power Co, L. A. Nichols is new president** succeeding Howard J. Underhill . . . At Duquesne Light, Daniel E. Nesbit is named general purchasing agent . . . At American Gas & Electric Service Corp, S. N. Fiala is elected vice president and chief engineer . . . H. V. Rathbun is new manager of transmission and distribution at Western Light & Telephone (p 215).

MANUFACTURERS ▶ **Electrical manufacturers report a record 44,449 Mw of generating capacity was scheduled for future shipment** as of April 1 of this year. This tops the previous record of last Oct. 1 by almost 2,000 Mw. Scheduled shipments in 1958 for both thermal and hydraulic generating capacity now stands at 17,440 Mw, exceeding this year's scheduled shipments of 14,650 Mw. These figures are from EEI's latest power survey (p 191). John A. Roebling's Sons Corp is completing a $2.5 million expansion program which includes addition to its cable plant and new research facilities . . . Ampere Industries is organized to manufacture electric heating equipment (p 198).

NEW EQUIPMENT ▶ **Line construction truck designed for city operation** features short overall length, wide-tread front axle, and short turning radius to provide good maneuverability under crowded traffic conditions . . . Also on the market is a new line of compression connectors which may be used to splice both aluminum and copper conductors without electrolytic action. They're made of aluminum with hot tin coating (p 134).

ENGINEERING TRENDS

Twelve independent and identical heat exchanger units will be used to prevent complete failure of the heat removing plant for the fast breeder reactor at Dounreay, Scotland. Each unit will comprise two primary liquid metal circuits, one secondary liquid metal circuit, a heat exchanger, and a dump condenser.

No signs of wear, erosion, or other distress on the blades have been apparent after 325 hours' operation in the latest phase of the Bituminous Coal Research Locomotive Test Program. Blades have been modified to reduce dust damage in the gas turbine designed for coal firing.

Distribution regulators are much more flexible for application to various circuit requirements as result of "load range"—ability to carry more than normal current when limited to less than full regulation. Surveys show most units are used in lines where full $\pm 10\%$ voltage range cannot be used without operating outside the favorable zone voltage recommended by NEMA for lighting and appliances.

Greater uniformity in terms used for automatic station and supervisory equipment is expected from recent revision of American Standard on Automatic Station Control. More uniformity in representing contacts on electrical diagrams is also hoped for by virtue of a new section added to the Standard.

Drift from cooling towers can be a hazard to roads and electrical equipment. These towers evaporate substantial volumes of water when they operate and this water can condense as fog to obstruct visibility or freeze on wires, highways and electrical apparatus.

Solar radiation heats an office building in New Mexico despite cloudy weather during the coldest part of winter. Water, heated by sunshine reflected by a "flat plate collector," is stored until needed in a 6,000-gal tank. Another paper on the same ASME program concludes that most areas of the U. S. have enough solar energy to heat domestic water in summer for domestic use.

Aluminum coils in transformers may require higher grade steel in the cores to maintain the same no load losses as are customary with copper coils, according to Electrical Review.

Series capacitors enable 25-cps rectifiers to use 60-cps supply for heavy-traction applications, thereby permitting traction operators to supplement their 25-cps systems with 60-cps power purchased from electric utilities and fed directly to part of the trolley system.

Cooling towers can be a fire hazard if not operated continuously and kept wet. During periods when their operation is not required, they can be protected against this hazard by running the pumps about once a week to keep the wood thoroughly saturated.

VAREX

...EVERYTHING YOU WANT IN A CAPACITOR

Here's why you'll like the new VAREX Capacitor

... internal discharge resistors for safety of operator

... highest grade paper dielectric

... low-temperature-type askarel insulating liquid

... annealed aluminum foil

... FOIL COOLING ASSURES EFFICIENT DISSIPATION OF HEAT

... spring pressure holds plates in contact with foil ends . . . no need for buried tabs with their crimped, soldered or welded connections

... horizontal position of elements facilitates cooling, allows elements to be short and structurally sound

ON THE INSIDE

ON THE OUTSIDE

...low silhouette . . . Varex meets all limiting NEMA dimensions, is shorter than most capacitors.

...safety-strip terminals protect stud, bushing and seal.

...long-leakage-distance bushings made of O-B wet process porcelain.

...effective solder-seal fastens bushing to case.

...big, open lifting eye to accommodate wide range of hooks and clevises.

...new epoxy-resin paint has indicated life of several times that of paint normally used on this class of material.

...extra-large nameplate for easy identification.

...recessed bottom to protect against scratching during handling.

Varex elements are wound in air-conditioned plant to insure quality and uniformity of product.

Ohio Brass

OHIO BRASS COMPANY • MANSFIELD, OHIO

... available in both 25 and 50 KVAR units.

... eight voltages for each KVAR rating — 2400, 2770, 4160, 4800, 6640, 7200, 7620, 7960.

... NEMA Standard hangers for one, two, three or four units.

... factory-assembled, pole mounted equipments with in-line or rectangular configuration, up to 12 units switched and unswitched.

... factory-assembled, substation equipments for building banks of any desired size.

... units, hangers and equipments meet all national standards for dimensions and performance.

ASK YOUR O-B DISTRICT MANAGER FOR COMPLETE CATALOG INFORMATION ON NEW VAREX

— the cool capacitor

OHIO BRASS COMPANY • MANSFIELD, OHIO

O-B Varex... a complete line of Shunt Capacitors to fill all your needs

Including Substation and Pole-Mounted Equipments made to NEMA standards

Ohio Brass

4754—H

50 KVAR

for 4800, 6640, 7200, 7620 and 7960 volts.

for 2400, 2770 and 4160 volts.

25 KVAR

for 4800, 6640, 7200, 7620 and 7960 volts.

for 2400, 2770 and 4160 volts.

Savannah Electric and Power Reports:

TROUBLE-FREE COMMUNICATIONS FOR FOUR YEARS WITH GENERAL ELECTRIC TWO-WAY RADIO

For the past four years, the Savannah Electric and Power Company has depended upon trouble-free G-E two-way radio to coordinate maintenance, transmission, and construction crews throughout a five-county, fifty-mile city radius.

General P. E. Seawright, Superintendent of Transmission and Distribution for Savannah Electric and Power, reports his organization has never experienced a serious break in two-way radio communications, during four years of operation. He credits General Electric's dependable equipment, teamed with a maintenance program provided by the local General Electric Authorized Service Station, for assuring his firm of full 24-hour radio services.

Radio Cuts Service Loss Time

Seventeen mobile units in the fleet of service and supervisory vehicles are coordinated by radio from the office of General Seawright, in the Savannah office.

General Seawright credits the G-E two-way radio system for speedy assists in the restoration of service in emergencies. This is a vital factor to the thousands of homes and commercial installations over 1000 miles of line.

New Progress Line Radio

General Electric's new Progress Line radio provides full chassis, interchangeability, plug-in chassis, and new 6600 series tubes, specially designed and tested for radio communication circuits.

Your Communications Counselor can give you full details. Call him in, or, write: *General Electric Co., Communication Equipment, Section 967-24, Electronics Park, Syracuse, N. Y.* In Canada, write: *C.G.E. Electronics, 830 Lansdowne Avenue, Toronto.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

PRIMARY UNIT SUBSTATIONS

CUSTOM BUILT FOR YOU —AT NO EXTRA COST

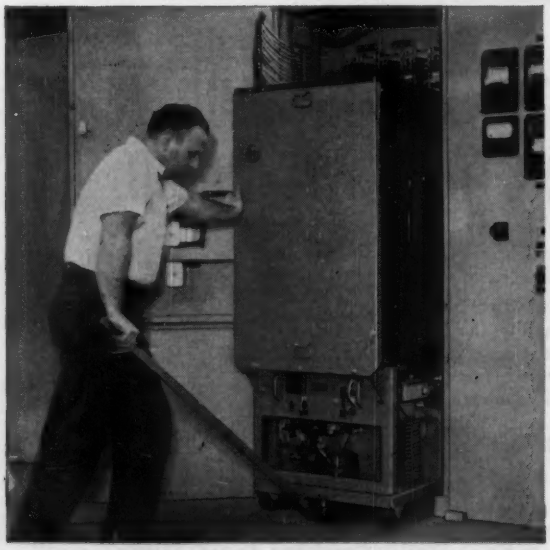
Here at I-T-E, complete primary unit substations are custom designed and engineered to meet your particular requirements. I-T-E engineers skillfully knit together quality I-T-E substation components in a way to give you the advantages of versatility, reliability, safety and convenience.

Particular emphasis is placed on ease of installation to meet all your requirements for growth and relocation, with full regard to an appearance that fits well into your surroundings.

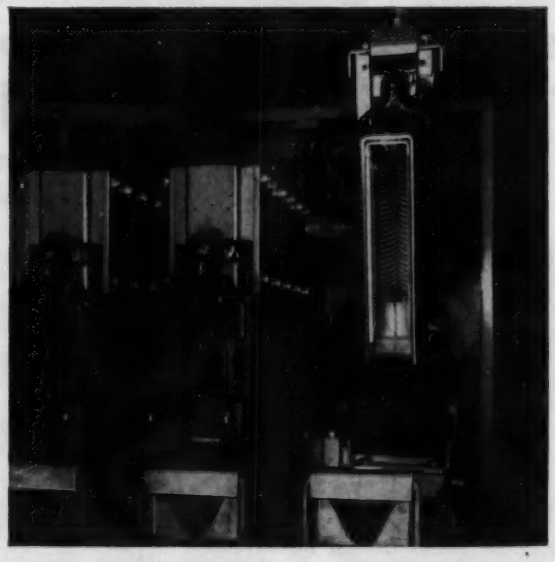
Typical I-T-E quality manufacturing standards further insure that your substation will give you the maximum reliability and performance at the lowest cost. Delivery can be made in accordance with your own construction schedule. You can save time, trouble and money in completing the final job.

I-T-E primary unit substations are available for any application and in any standard rating. For details, call the I-T-E sales office near you. Or write I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.

Engineered to insure the best value

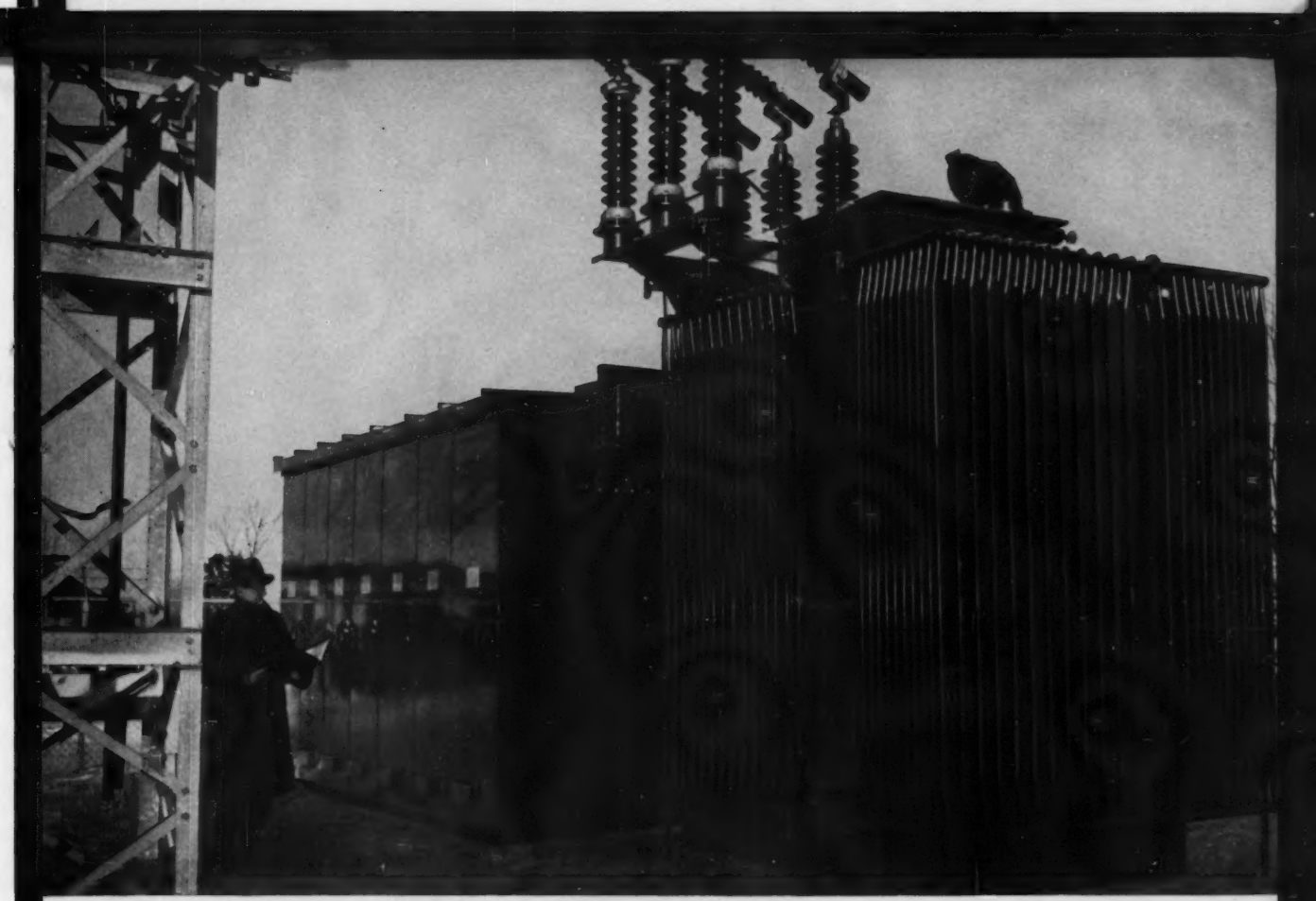


Horizontal drawout air circuit breakers. Even heavy 13.8-kv circuit breakers roll out easily on permanently attached wheels. Safety shutters automatically close over bus openings when breaker is moved to test position or from enclosure.

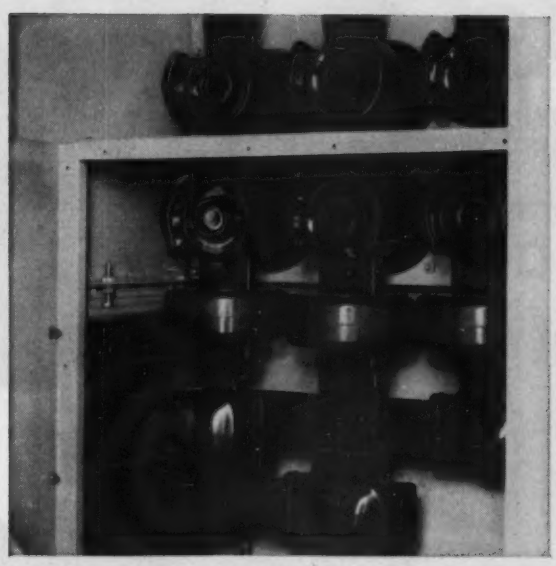


Positive arc interruption. Double coil, closed iron magnetic circuit produces intense magnetic effect, drives arc rapidly and uniformly between plates in arc chute, where it is extinguished, giving faster interruption, longer arc chute life.

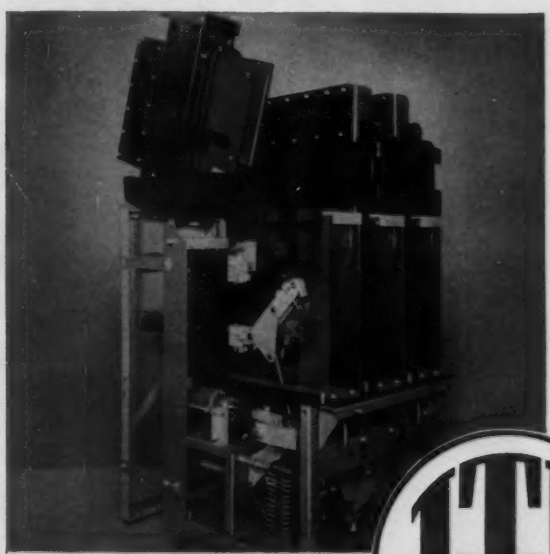
I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division



and the most reliable performance

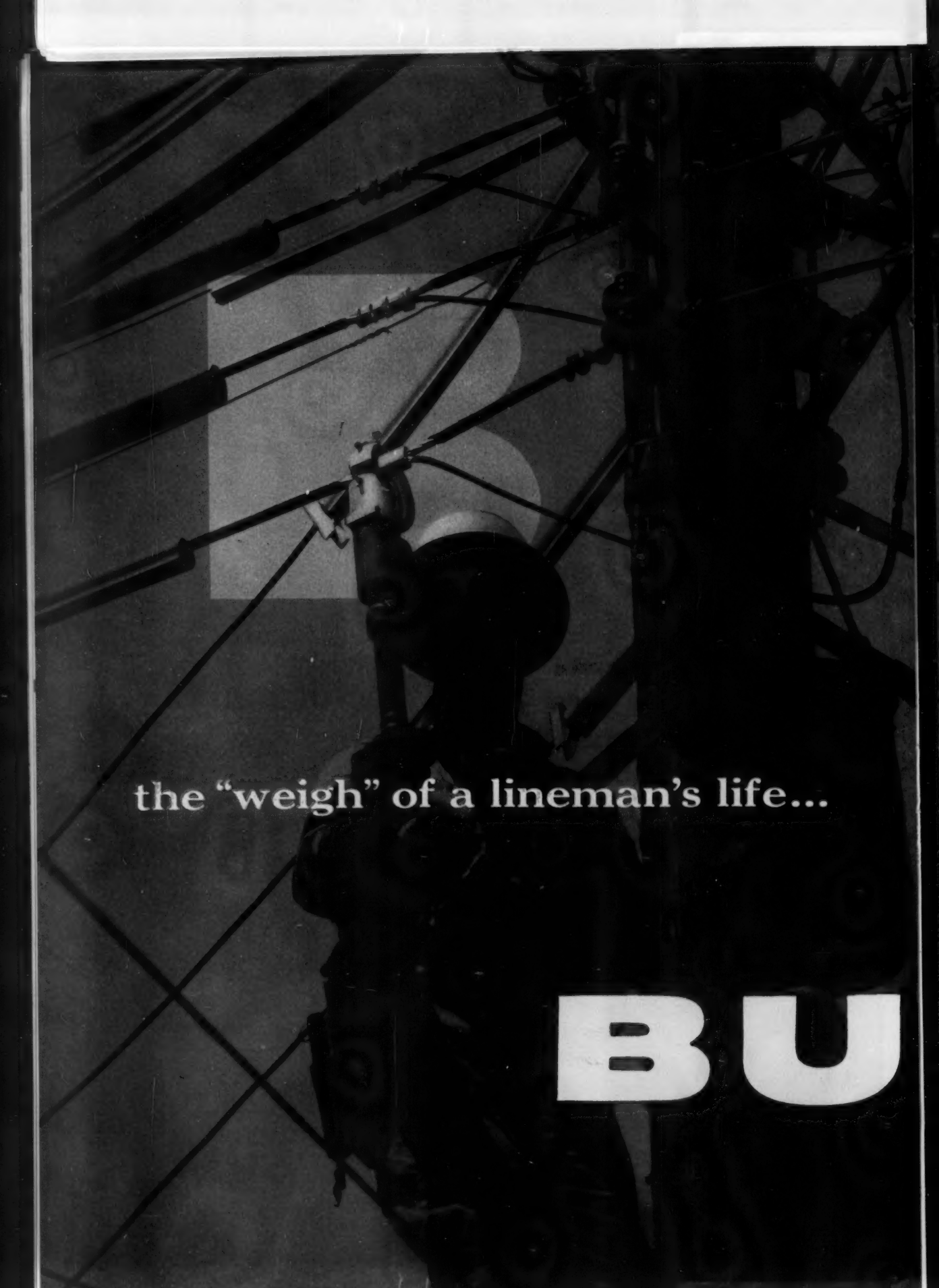


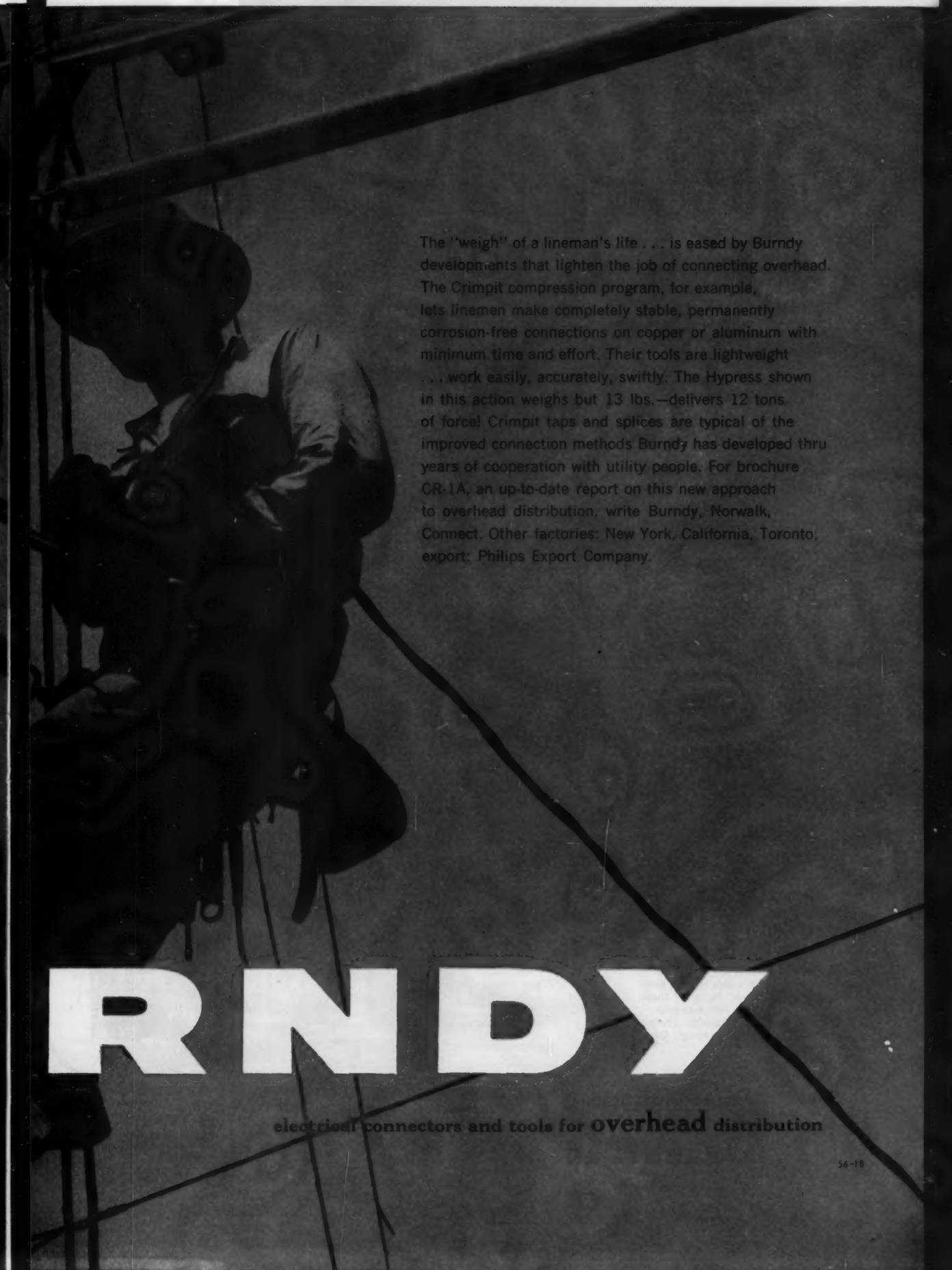
Fully isolated main bus with flame-retardant insulation. Bus is held in alignment against short circuit stress by porcelain bus supports. Flame-retardant insulation covers entire bus, including porcelain primary disconnect housings.



Simplified maintenance. Pivoting arc chutes simplify routine inspection and upkeep. Auxiliary devices are positioned to permit easy access.

IN CANADA: EASTERN POWER DEVICES LTD.


the "weigh" of a lineman's life...
BU



The "weigh" of a lineman's life . . . is eased by Burndy developments that lighten the job of connecting overhead. The Crimpit compression program, for example, lets linemen make completely stable, permanently corrosion-free connections on copper or aluminum with minimum time and effort. Their tools are lightweight . . . work easily, accurately, swiftly. The Hypress shown in this action weighs but 13 lbs.—delivers 12 tons of force! Crimpit taps and splices are typical of the improved connection methods Burndy has developed thru years of cooperation with utility people. For brochure CR-1A, an up-to-date report on this new approach to overhead distribution, write Burndy, Norwalk, Connect. Other factories: New York, California, Toronto; export: Philips Export Company.

BURNDY

electrical connectors and tools for overhead distribution

56-18

EXPANSION JOINTS

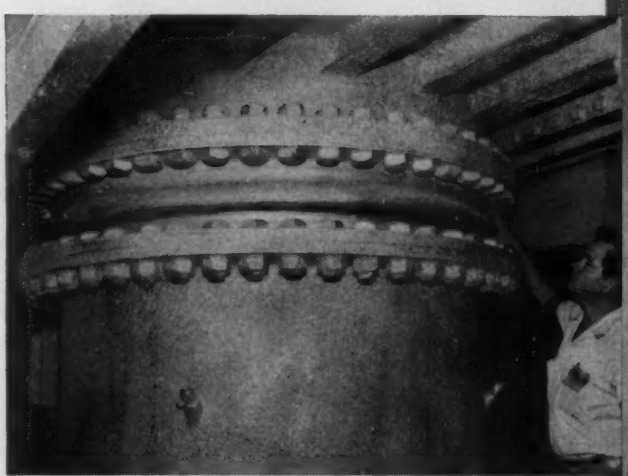
84,000 Gallons of Water per Minute for atomic energy plants

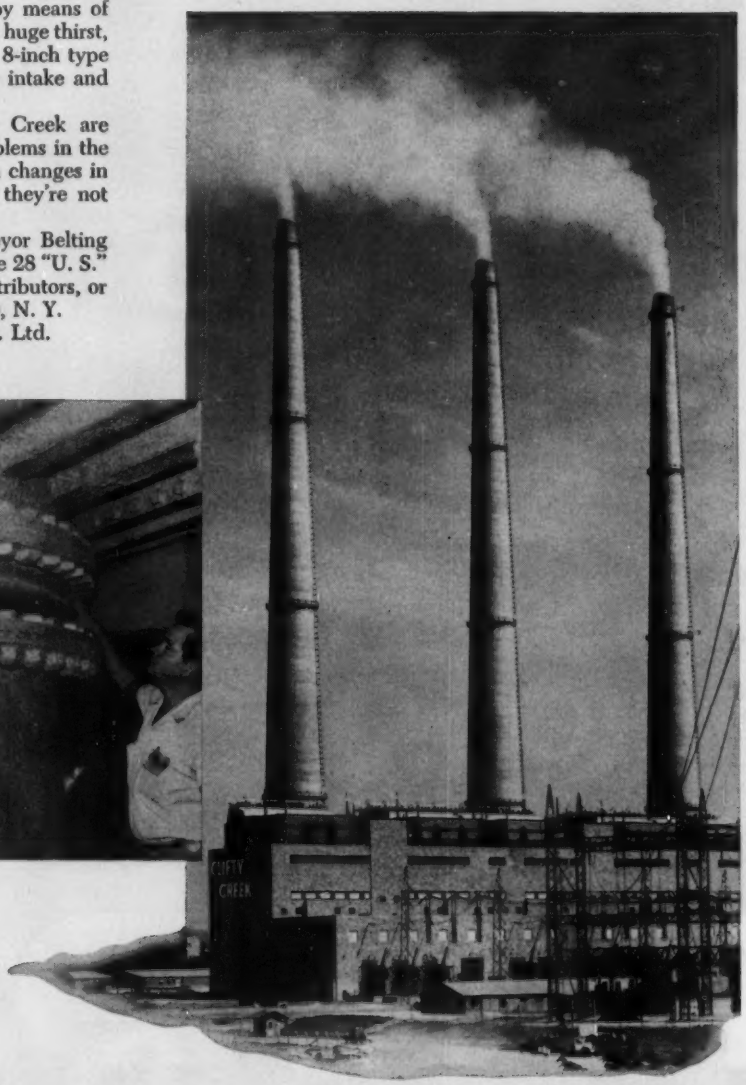
The Clifty Creek steam electric plant brings in and expels river water at 84,000 gallons per minute, by means of circulating water pumps. To help quench this huge thirst, U. S. Rubber Expansion Joints (from small 8-inch type to big 66-inch type) are used on the water intake and discharge pipes.

These U. S. Expansion Joints at Clifty Creek are handling the contraction and expansion problems in the pipe lines excellently. They can take sudden changes in temperature, they can handle shocks, and they're not bothered by corrosion.

A complete line of U. S. Rubber Conveyor Belting and Expansion Joints is available at any of the 28 "U. S." District Sales Offices, at selected "U. S." distributors, or write us at Rockefeller Center, New York 20, N. Y.

In Canada, contact Dominion Rubber Co. Ltd.





Above is one of the many 66-inch U. S. Expansion Joints on a water intake line at the Clifty Creek Plant. None of these joints, no matter what the size, has ever given Clifty Creek any problem. They are performing excellently, on a tough job.

Mechanical Goods Division

United States Rubber

Racks are designed for a minimum space requirement and can be passed through a 30"-diameter manhole.

Submersible equipments...

L-M's New Secondary Network Capacitors Increase Capacity, Improve Voltage

Line Material's new 216 volt, 13⅓ kvar submersible capacitor equipments can be your answer to heavier network loading. Secondary capacitors will improve the low power factor of heavy motor loads, such as air conditioning. This substantially reduces loading on conductors and transformers, and helps to improve low voltage conditions. Capacitor units can be installed more quickly and at much less cost than system changes, such as larger transformers, cables and additional vaults.

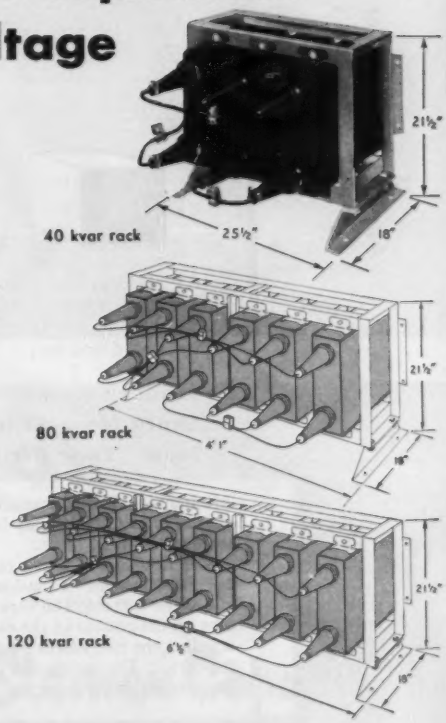
L-M's new secondary capacitors have outstanding product features such as aluminum metallic coating under a primer and finish coat of alkyd resin paint, strong solder-sealed bushings, and low-temperature Elemex liquid dielectric. Each unit is equipped with one terminal mounted current limiting fuse; bushings are enclosed in water-tight covers.

Capacitor Racks

Capacitor units are available in 40, 80, and 120 kvar racks, entirely assembled at the factory and ready for installation in the field. Racks can be stacked or mounted on floor, wall, or ceiling in many arrangements to fit vault space. Ambient temperature limits are 55° C. for single-tier equipments and 40° C. for two- or three-tier equipments.

Get Complete Information

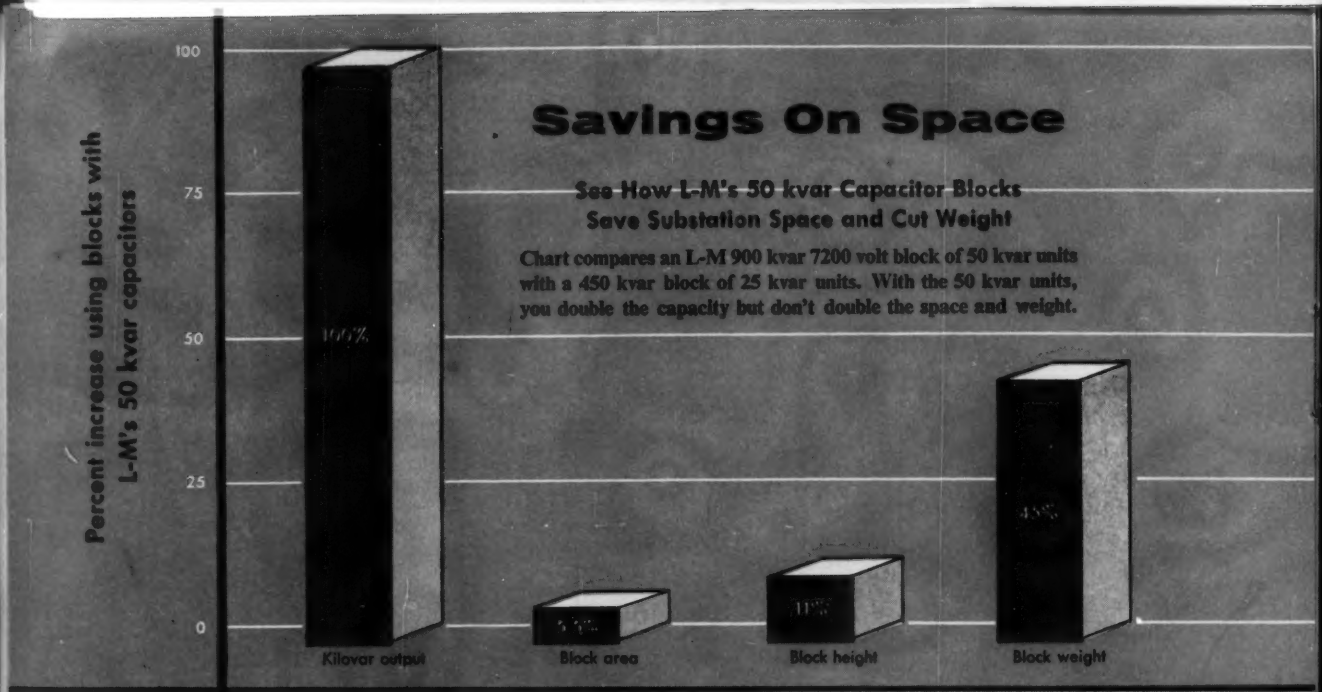
Ask the L-M Field Engineer for information on features, design, and delivery on L-M's new secondary network capacitors and capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin



LINE MATERIAL
McGRAW-EDISON COMPANY

247-R

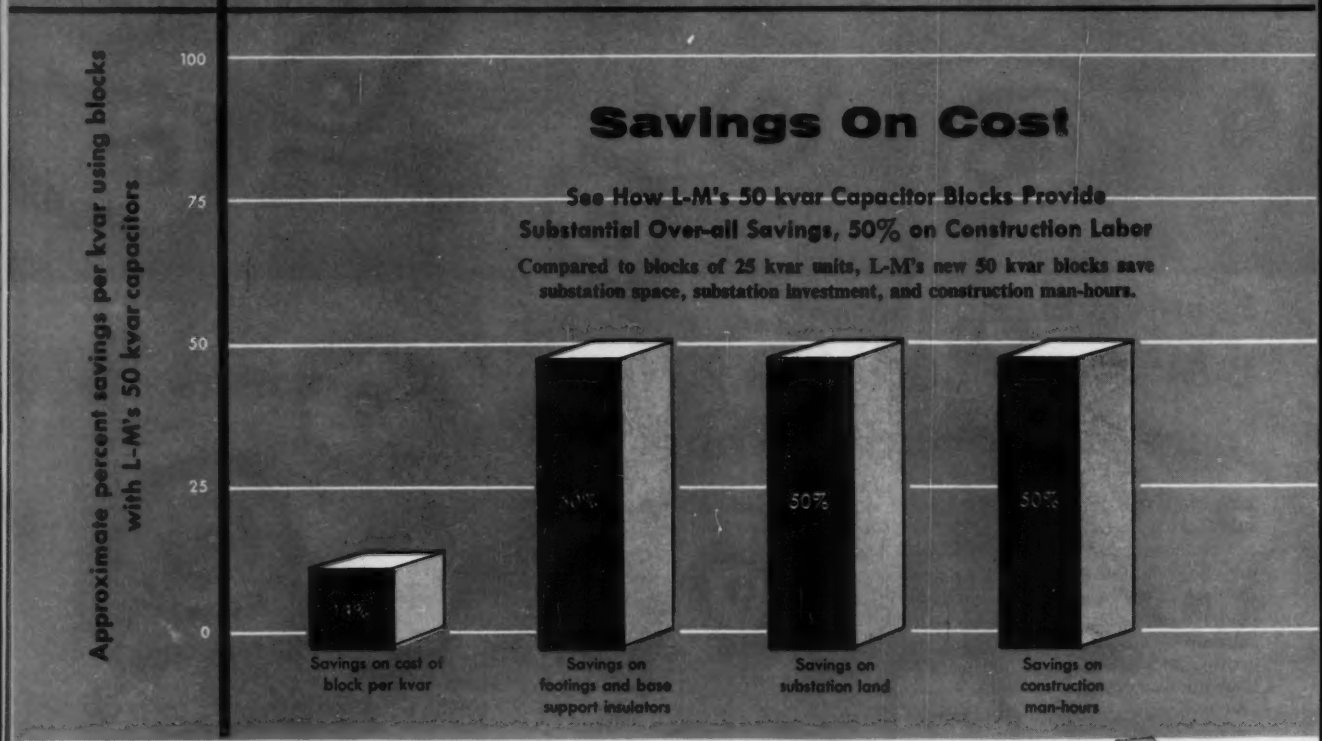
Elemex® Capacitors



Savings On Space

See How L-M's 50 kvar Capacitor Blocks Save Substation Space and Cut Weight

Chart compares an L-M 900 kvar 7200 volt block of 50 kvar units with a 450 kvar block of 25 kvar units. With the 50 kvar units, you double the capacity but don't double the space and weight.



Savings On Cost

See How L-M's 50 kvar Capacitor Blocks Provide Substantial Over-all Savings, 50% on Construction Labor

Compared to blocks of 25 kvar units, L-M's new 50 kvar blocks save substation space, substation investment, and construction man-hours.

ANOTHER L-M CAPACITOR FIRST . . .

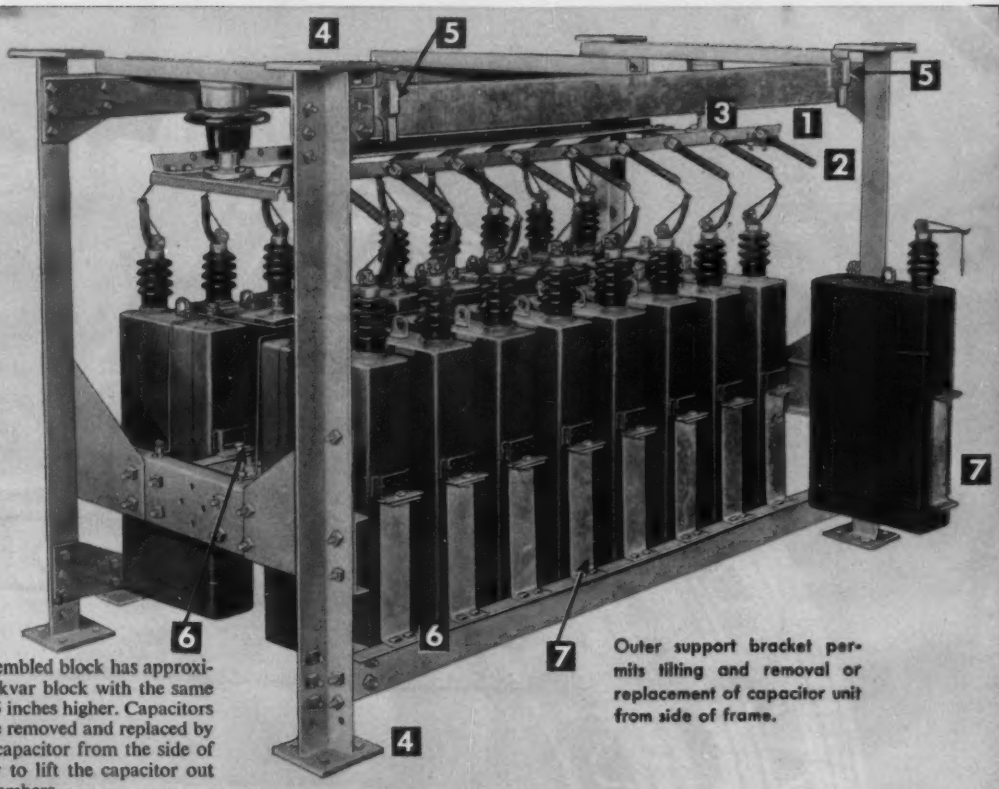
Units Now Shipped in New "Tear Strip" Carton

All individual L-M capacitor units are now packed in cartons that can be quickly and easily removed.

The new carton has a reinforced cloth tape cemented around the inside about two inches above the bottom. The tape is attached to pull tabs on the outside of the carton. When the tab is pulled, the tape makes a cut completely around the carton. The carton can then be quickly and easily lifted off the capacitor.

Simply pull the tape—to remove the carton.

296-R


1 Aluminum-alloy bus
2 Bus-mounted fuses
3 Bus connections wire brushed and treated with oxidation inhibitor.
4 Jig-assembled for perfect alignment of mounting pad bolt holes.
5 Lifting lugs.
6 Tapped holes in frame for capacitor mounting bolts. Nuts not needed.
7 Outer support bracket permits tilting and removal or replacement of capacitor unit from side of frame.

L-M's new 50 kvar factory-assembled block has approximately the same area as a 25 kvar block with the same number of units and it is only 5 inches higher. Capacitors in L-M's 50 kvar blocks can be removed and replaced by simply tilting and sliding the capacitor from the side of the block. It is not necessary to lift the capacitor out from between the mounting members.

Another L-M First...

L-M's 50 Kvar Capacitor Blocks Provide Kilovars At Still Lower Costs

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors and Regulators
Line Material Industries

Only half as many units are required in substation capacitor banks when you use L-M's new blocks of 50 kvar capacitors. In addition, these blocks reduce the number of fuses, footings, and base support insulators, as well as the construction man-hours required for any given-size bank. L-M 50 kvar preassembled capacitor blocks also cost less and require about 50% of the substation area per kvar in comparison with blocks containing 25 kvar capacitors.

Capacitor Unit

The internal construction of L-M's 50 kvar capacitor is identical with that of the 25 kvar unit except for the length of pack. There is no increase in voltage stress to get the higher kvar rating. The new design is the result of continued improvement in dielectric materials and manufacturing techniques.

The tank has the same width, same thickness as the 25 kvar capacitor. Only 10 inches of additional height give you twice the capacity. It also has aluminum-metallized coating under alkyd resin paint; paragroove clamp-type terminals; strong solder-sealed bushings; and low-temperature Elemex liquid dielectric.

Factory-Assembled Blocks

L-M offers a complete line of NEMA Standard 50 kvar factory-assembled blocks from 2400 through 7960 volts—400 to 1200 kvar ratings in 100 kvar increments.

Outstanding features of L-M factory-assembled blocks include:

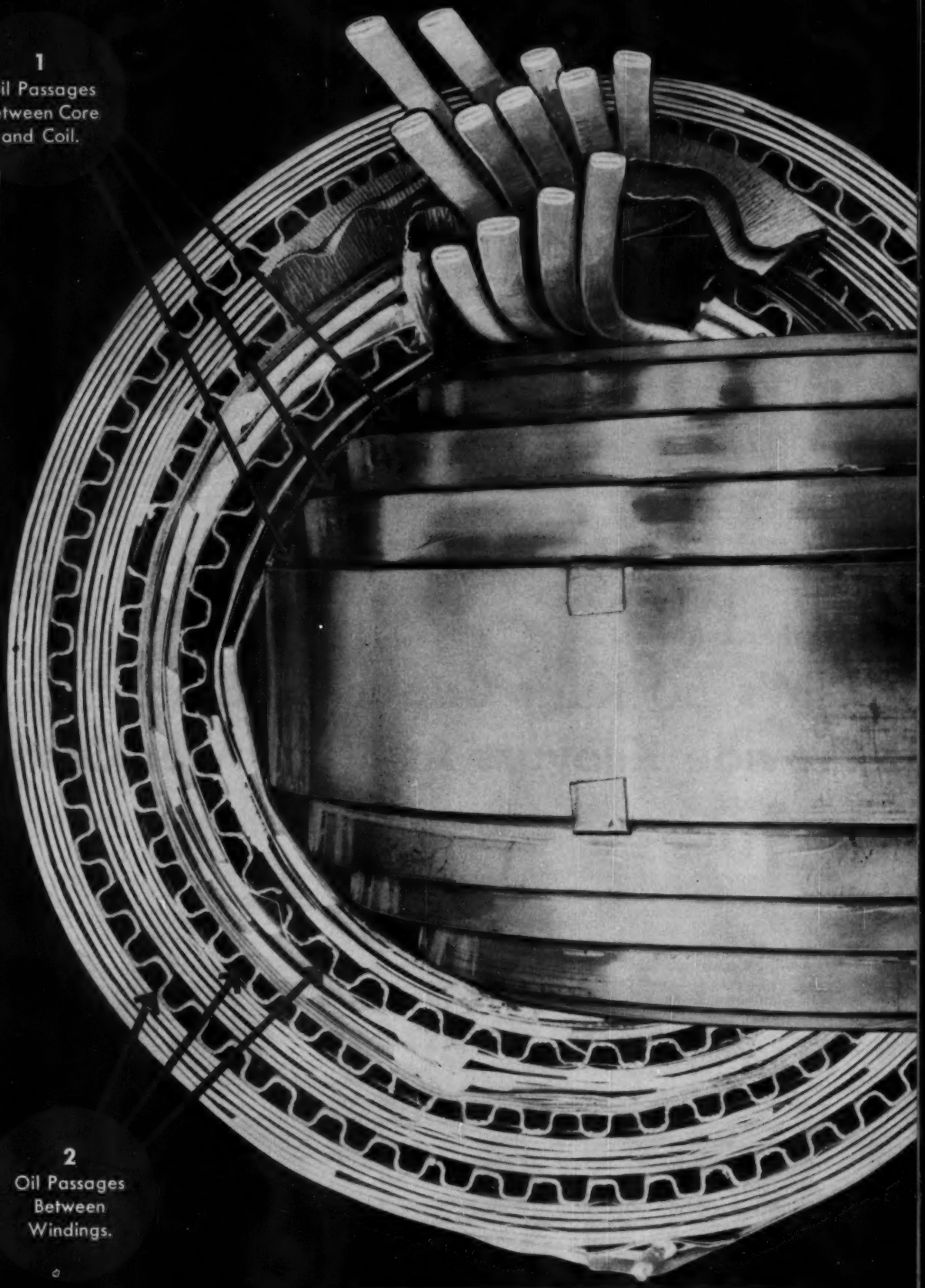
- Aluminum-alloy bus which is not subject to cold flow.
- Bus-mounted capacitor fuses with stainless-steel flipper to eject the leader if fuse link ever blows. Leader cannot hit live parts.
- Connections to the bus are wire brushed, and treated with oxidation inhibitor.
- Height of block is increased only 5 inches, because it is so designed that capacitors can be installed and removed from the *side*. It is not necessary to provide clearance to lift the capacitor out from between the mounting members.
- Heavy galvanized frame is jig-assembled for perfect alignment of mounting-pad bolt holes.

Prompt Delivery Now

You can save on the cost of equipment, man-hours, and space in the substation when you specify L-M NEMA Standard 50 kvar capacitor equipments. Prompt delivery . . . on all sizes and voltage ratings. Ask your L-M Field Engineer for complete information on L-M's new 50 kvar factory-assembled capacitor equipments. Or write Line Material Industries, Milwaukee 1, Wisconsin.

McGRAW EDISON

LINE MATERIAL Industries Elemex® Capacitors
McGRAW-EDISON COMPANY



L-M Round-Wound transformers have large, unobstructed areas exposed to cooling oil between core and coil (1), between windings and layers (2), and on the outside of the coil. The result is appreciably lower hot-spot temperature—high short-time overload capacity.

Here's Why

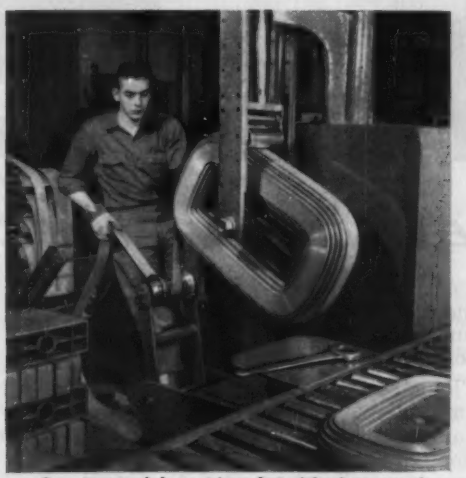
L-M's Round-Wound® Core-Coil Design Gives High Performance

By A. C. WURDACK
Chief Engineer
Large Distribution Transformers
Line Material Industries

L-M's wound-core, round-coil construction provides the most efficient design for obtaining balanced transformer performance characteristics.

Low Losses

The transformer core consists of a tightly wound, continuous strip of high-grade oriented steel. The core is not cut, unwound, or disturbed in any way after annealing. This results, therefore, in low exciting current, low core loss, and high magnetic efficiency.



Core is wound from strips of steel having several different widths, resulting in a cruciform cross-sectional area approaching an ideal round shape.

L-M's Round-Wound core permits the effective use of a round coil which has a much smaller perimeter than a coil placed around a rectangular core of the same cross-sectional area. L-M's design, therefore, permits smaller turn diameters, resulting in lower impedance and better regulation at all power factors.

High Short-Time Overload Capacity

L-M's Round-Wound transformers have natural oil passages between the cruciform cross-section core and round coil (1) to provide the greatest possible exposure of coil surface area to cooling oil. In addition, duct spacers placed between windings (2) and between layers in most sizes provide additional oil circulation. L-M's core-coil construction, therefore, provides more efficient dissipation of heat from the coils to the oil. The results are lower hot-spot temperatures, and higher overload capacity, or greater over-all life of the transformer.

L-M's round coils are wound directly onto the uncut core. No malleting is required to shape. Long creepage distance between windings and between leads, gives higher impulse strength.

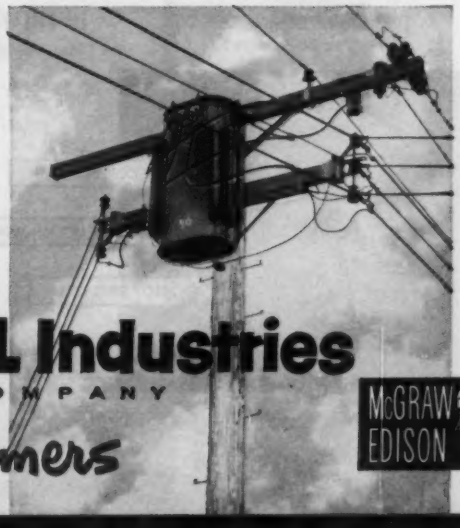
High Short-Circuit Strength

Under short circuits, rectangular coils tend to distort to a round shape, with resultant insulation damage or failure. L-M's round coils are not subject to this distortion when under heavy short-circuit currents, because the coils are already circular in shape. The radial forces are distributed evenly, with little or no effect on the coil. Sturdy clamping structure and varnished coils provide strong mechanical support to prevent axial movement.

Another advantage is L-M's new obround tank design. The transformer is smaller, lighter, and has shorter moment arm distance from the pole.

Get Complete Information

Ask your L-M Field Engineer for complete information on L-M Round-Wound transformers. Or write Line Material Industries, Transformer Division, Zanesville, Ohio.



LM®

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

Transformers

McGRAW EDISON

at NEW LOW PRICES!

These prices mean new economy for you, because they make the annual cost of Copperweld* Guy Strand even less than before—and it always has cost less per year of service than ordinary strand.

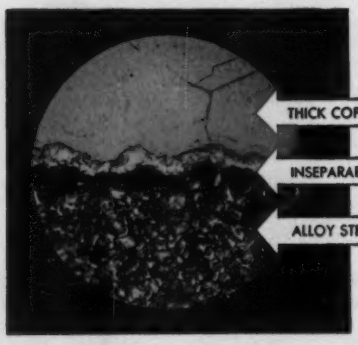
Copperweld Type M Guy Strand is easy to handle. It is flexible and pliable—can be readily bent, served, moused or clamped. The heavy copper sheath of each wire, inseparably molten-welded to the alloy steel core by the exclusive Copperweld process, will not crack, flake or peel.

Seven strengths are available: 3-wire strand in strengths of 2.2M and 4M; 7-wire strand in strengths of 6M, 8M, 10M, 12.5M and 16M. Start now to save more by using Copperweld Type M Guy Strand. Our field engineers will be glad to tell you about it.

*Trade Mark

COPPERWELD STEEL COMPANY WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York



microphotograph of weld area of Copperweld Wire, greatly enlarged

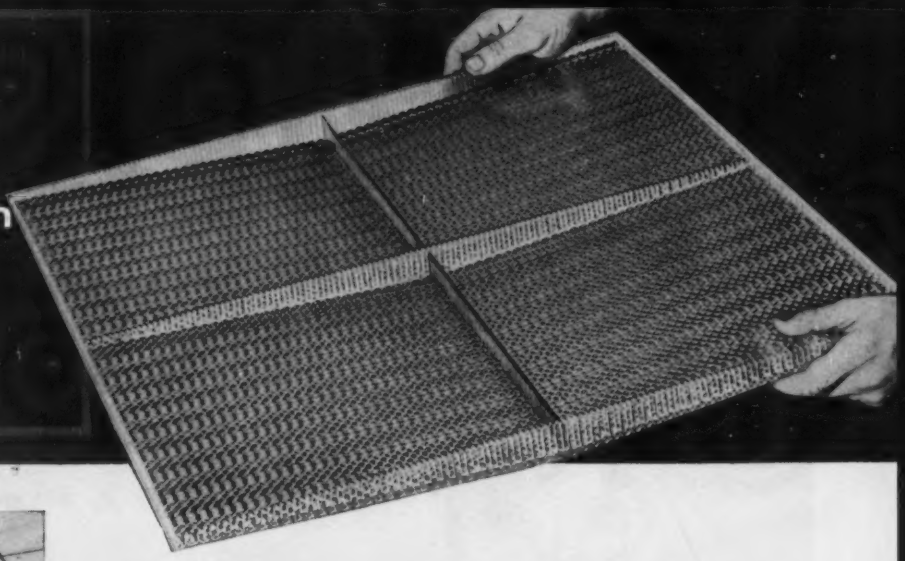
—AND REMEMBER,

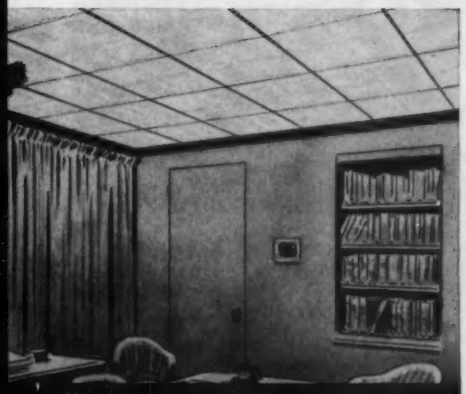
THE MOLTEN-WELD

MEANS

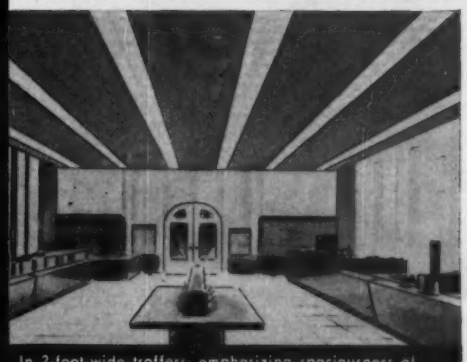
proved dependability and long life

HOLOPHANE ENGINEERS Break Through the GLARE BARRIER...

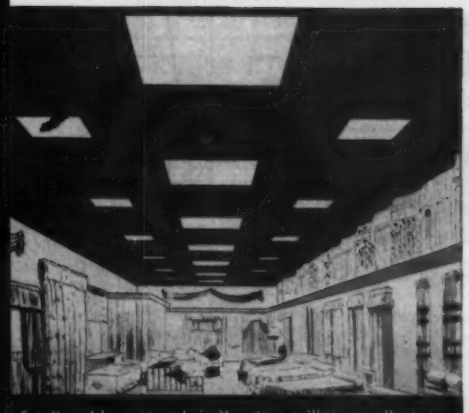




No. 6024 in large ceiling panels; effective lighting for executive offices.



In 2-foot-wide troffers; emphasizing spaciousness of the bank interior.



Small and large panels in the store ceiling; excellent illumination for seeing and selling.

Prismalume* Controlens* No. 6024 Introduces New Concepts in Fluorescent Light Control

There's a new trend in lighting — heralded by this two-foot-square HOLOPHANE CONTROLENS*. . . It produces the highest illumination with complete visual comfort! With your first step into an interior illuminated by this CONTROLENS you sense that something new and stimulating has been achieved with the lighting . . .

Due to prismatic control, maximum light is delivered on the work plane. This CONTROLENS can be used in two-foot-wide troffers (continuous runs), geometric groupings, or large luminous panels . . . Its sleek, handsome design conforms with the modern decor of offices, banks, stores, lobbies, showrooms, auditoriums and an unlimited variety of other areas. Write for complete engineering data today.

The Name HOLOPHANE *is your Surest Guide to Lighting* QUALITY

High-speed pressing and rolling are cost-cutting ways of making prismatic panels—acceptable only where quality is unimportant . . . This is definitely *not* the Holophane method. Every HOLOPHANE lens is carefully and *individually* pressed on specialized equipment. Only by this painstaking process can we make prismatic forms accurate enough to direct light precisely where it is needed. HOLOPHANE Lenses are the basic components of *custom-engineered* illumination systems, specifically designed for each lighting requirement . . . To be sure of quality in prismatic CONTROLENS* Refractors or Reflectors, look for the name "HOLOPHANE" impressed on each piece.

For Better Lighting Holophane *... Be Specific*

*Trademark

HOLOPHANE
COMPANY, INC. • *Lighting Authorities Since 1898*
342 Madison Ave., New York 17, N.Y.

"CRESTOGRIP"

The NEW Utility Plier

BY CRESCENT

30% THINNER
TWICE AS STRONG
GRIPS LIKE A PIPE WRENCH

CLEAN, SHARP TEETH
FLUSH RIVET NO PROJECTIONS
BOX JOINT ADJUSTABLE TO 4 POSITIONS UP TO 1½" CAPACITY
EXTRA THIN—ONLY ½" AT THICKEST POINT
NON-SLIP CHECKERDOT KNURLING
CRESCENT JAMESTOWN, N.Y. U.S.A.
P-210
PATENT PEN

Crescent's No. P210 Utility Plier is completely new ... revolutionary! It's not a "slip-joint" plier and not to be confused with conventional lap-joint "pump" pliers. Its *double-strong* box joint design is absolutely unique and assures a powerful grip like that of a pipe wrench without sideways twist or strain. It will grip flat, square, hex or round objects with powerful leverage.

QUICK, POSITIVE ADJUSTMENT

This cut-away view shows joint construction with its extra generous bearing surface at the arrow point. Adjustment is made by simply "walking" the rivet recess over the bearing point with a pumping action of the handles. Easy, positive, capable of heavy loads.

Handsomely finished in rust-resistant zinc plate. Overall length 9½ inches.

Sold by hardware dealers and industrial distributors everywhere.

CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence ®

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

RT&E Transformers

Weather Protected to Serve Longer

Like the postman, neither rain nor snow, nor hail, nor salt spray can prevent R T & E Transformers from doing their duty. Here's proof that every R T & E unit is completely "WEATHER PROTECTED."

- **FINISH:** Three coats of modified Alkyd paint for all season protection.
- **DESIGN:** Domed cover for immediate water run-off.
- **TANK:** Arc-welded seams and absence of lip on tank bottom mean no moisture collecting cracks and crevices.
- **BUSHINGS:** HV bushings internally clamped — no external clamps and bolts to corrode.

Plus stainless steel cover band to eliminate corrosion on accidentally scratched areas . . . stainless steel threaded mounting pads . . . all unpainted fittings either galvanized or electro-tinned.

R T & E "Weather-Protected" Transformers last longer, require less maintenance, serve better all year 'round.

Equipment to help provide power for America.

RT&E
CORPORATION
WAUKESHA, WISCONSIN

EAST or WEST... you get prompt delivery with

CF&I GALVANIZED STEEL STRAND

Need top-quality three- or seven-wire galvanized steel strand for guy, messenger, or overhead ground wire? Then, no matter what part of America you're in, one of our two modern plants—at Pueblo, Colorado or Buffalo, N. Y.—will quickly and efficiently fill your strand requirements.

What's more, in addition to prompt delivery, you're always sure of the quality of CF&I Galvanized Steel Strand. Every phase of its production is under the CF&I rigid quality control system . . . every phase of its production is supervised by the manufacturers of world-renowned Wickwire Wire Rope and Wire Rope Slings.

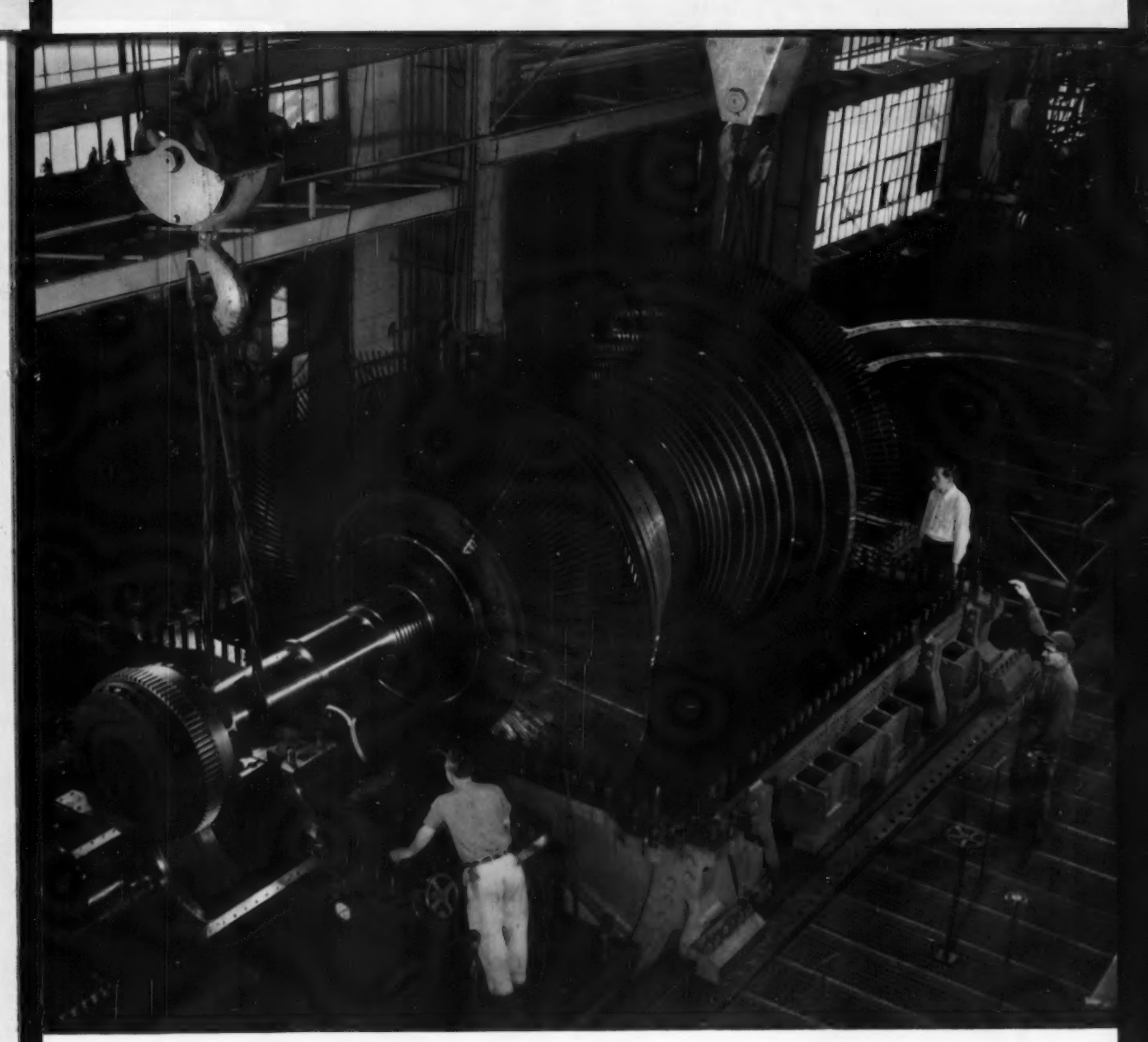
When you need strand—to your own or ASTM Specifications A-122 or A-363—it'll pay you to contact your nearby CF&I sales office.

GALVANIZED STEEL STRAND

THE COLORADO FUEL AND IRON CORPORATION

4473

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Kansas City Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City San Francisco • Seattle • Spokane • Wichita • CF&I OFFICES IN CANADA: Toronto • Montreal



VIBRATION CONTROL . . . makes Westinghouse turbine-generators the smoothest in operation

Of course, every rotating machine has a certain degree of vibration . . . how much, is the important factor.

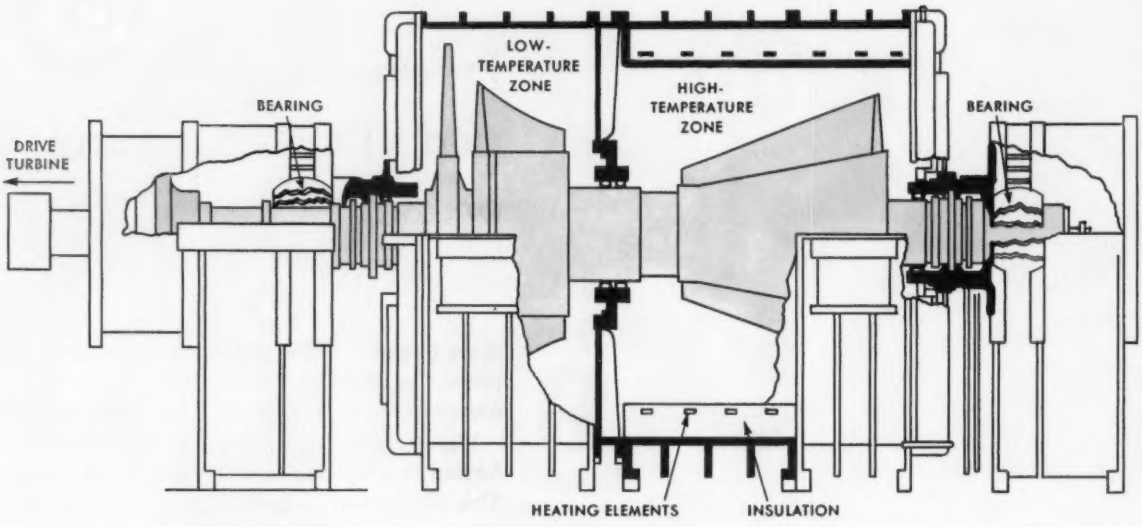
For years, Westinghouse has enjoyed a reputation for dependable, smooth-running turbine-generators. That reputation hasn't "just happened" . . . it is the result of years of hard work and intensive engineering.

The above "heater box" test equipment was designed and built . . . pioneered . . . by Westinghouse. It is the principal reason why Westinghouse turbines run smoothly from start-up. Field balancing is practically eliminated.

YOU CAN BE SURE...IF IT'S Westinghouse

TURN THE PAGE TO SEE WHY...

Westinghouse "heater box" balancing . . . makes the difference

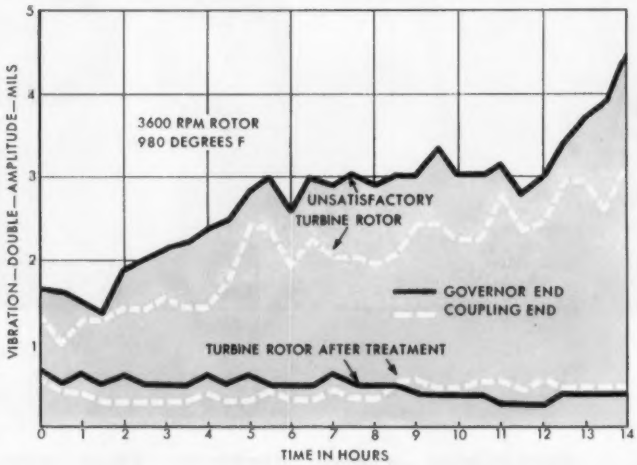


Diagrammatic sketch shows arrangement of typical Westinghouse "heater box." This is one of several in which high-temperature rotors are tested at full speed and operating temperature.

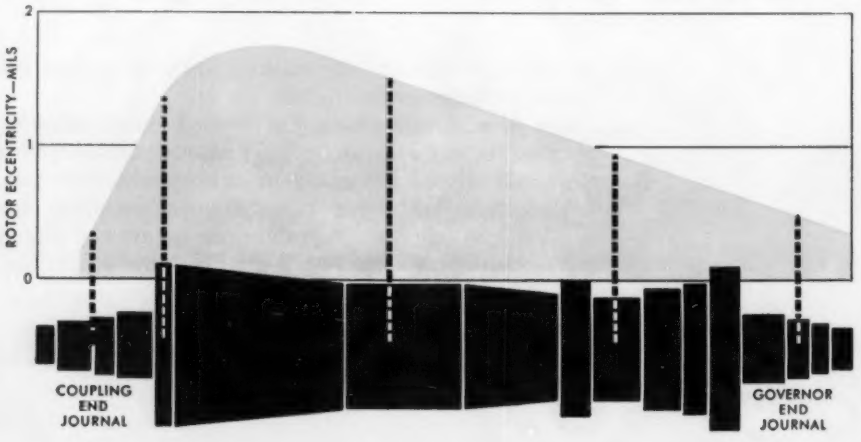
To have assurance of permanent balance, experience has proved it necessary to subject high-temperature turbine rotors to full-speed test at operating temperatures. Otherwise, balance characteristics, carefully developed during manufacture, may alter unpredictably when the machine is installed and operated.

For this reason, Westinghouse developed the "heater box."

Result: Westinghouse turbines . . . and only Westinghouse turbines . . . achieve a degree of permanence in balancing *prior to shipment* that is unequaled. Field balancing is practically eliminated.



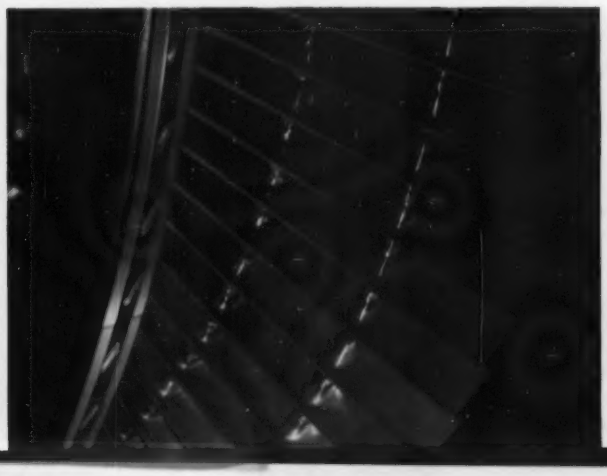
Vibration record. Upper curve indicates vibration build-up during full-speed run in a "heater box." Lower curve shows vibration record of the same rotor after "heater box" run and balancing.



Permanent rotor bowing is an example of what can happen after a rotor is run at full speed and operating temperature. With the "heater box" test, this can be detected and corrected prior to shipment.

Precision forging of a large blade to basic shape. Below: From billet to blade . . . only minor trimming of the blade and machining of the root are required after forging.

Blades are grouped by welding the integral lashing stubs together.



Precision forging and vibration control of blades

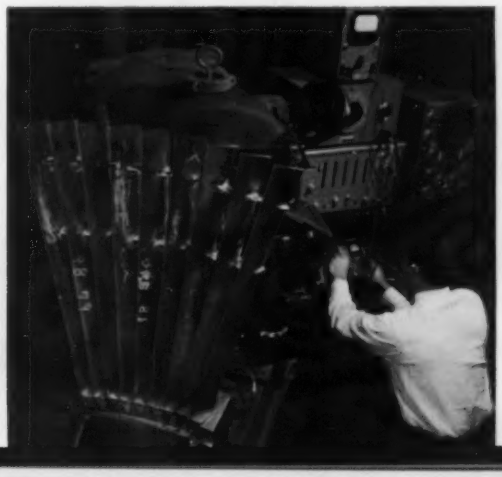
Since forged material offers the best structural properties, Westinghouse has developed techniques to forge all large blades to basic shapes.

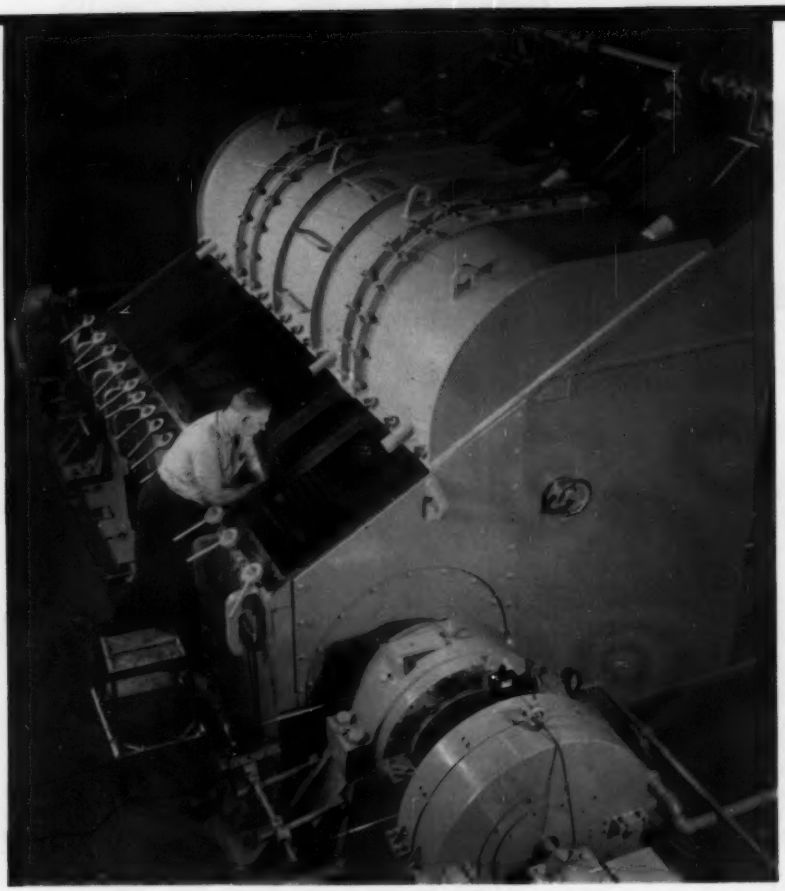
Westinghouse has also developed a method of forging lashing stubs integrally with the blade. This eliminates the possibility of heat of welding or brazing adversely affecting the metallurgical properties of the blade itself. After forging, only minor finishing is necessary to assure the thermodynamic and vibrational characteristics required by Westinghouse standards.

Each Westinghouse blade and group design is proved in extensive laboratory tests. These range from electronic tests of group designs, which determine natural frequencies, to rotating tests which check vibration at operating speed. Production line quality control makes certain that the established standards are built into the individual blades.

PLEASE TURN PAGE

Electromagnetic vibration test on a blade group in the laboratory. This electronic instrument checks the natural frequencies of the blade groups.





VIBRATION CONTROL in the generator rotor

Field balancing of Westinghouse generator rotors is seldom required because of the exacting care taken during all steps of manufacture, a fact verified by *shaft-riding*, vibration-sensing instruments.

Thermal Balancing—Prior to assembly, the Westinghouse generator rotor is checked in a high-speed balancing and seasoning box as shown above. Pioneered by Westinghouse, this testing technique assures the thermal stability of high-speed rotors. Heated to 130° C in this "heater box," the rotor is operated for eight hours at full speed. Any thermal distortion is detected and corrected, thereby eliminating this cause of vibration. The rotor is further checked for thermal balance in its own stator and bearings.

Slotted Pole Faces—Another feature pioneered by Westinghouse—transverse slots in the rotor pole faces equalize the moments of inertia about the two principal axes, thereby eliminating this cause of double-frequency vibration.

Alloyed Field Windings—More than 20 years ago, Westinghouse pioneered the use of cold-worked, silver-bearing copper which is not subject to permanent distortion and, therefore, helps to assure the mechanical stability of the rotor.

Both modern inner-cooled and conventional rotors are designed to take advantage of these time-proven techniques which assure smooth operation.

Contact your Westinghouse sales representative or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-50603

"Before" and "after" thermal balancing a generator rotor—a testing technique pioneered by Westinghouse.

YOU CAN BE SURE...IF IT'S Westinghouse

Bell Laboratories researchers Henry S. McDonald, Dr. Eng. from Johns Hopkins, and Max V. Mathews, Sc.D. from M.I.T., examine magnetic tape used in new research technique. Voice waves are converted into sequences of numbers by periodic sampling of amplitudes, 8000 samples per second. General purpose electronic computers act on these numbers as a proposed transmitting device might.

They send real voices on imaginary journeys

In their quest for better telephone service, Bell Laboratories researchers must explore many new devices proposed for the transmission of speech signals. For example, apparatus can be made to transmit speech in the form of pulses. But researchers must always answer the crucial question: how would a voice sent through a proposed device sound to the listener?

In the past it often has been necessary to construct costly apparatus to find out. Now the researchers have devised a way to make a high-speed electronic computer perfectly imitate the behavior of the device, no matter how complicated it may be. The answer is obtained without building any apparatus at all.

The researchers set up a "program" to be followed by the computer. Actual voice waves are converted into a sequence of numbers by sampling the waves 8000 times per second. Numbers and program are then fed into the computer which performs the calculations and "writes out" a new sequence of numbers. This new sequence is converted back into real speech. Listeners hear exactly how well the non-existent device could transmit a real voice.

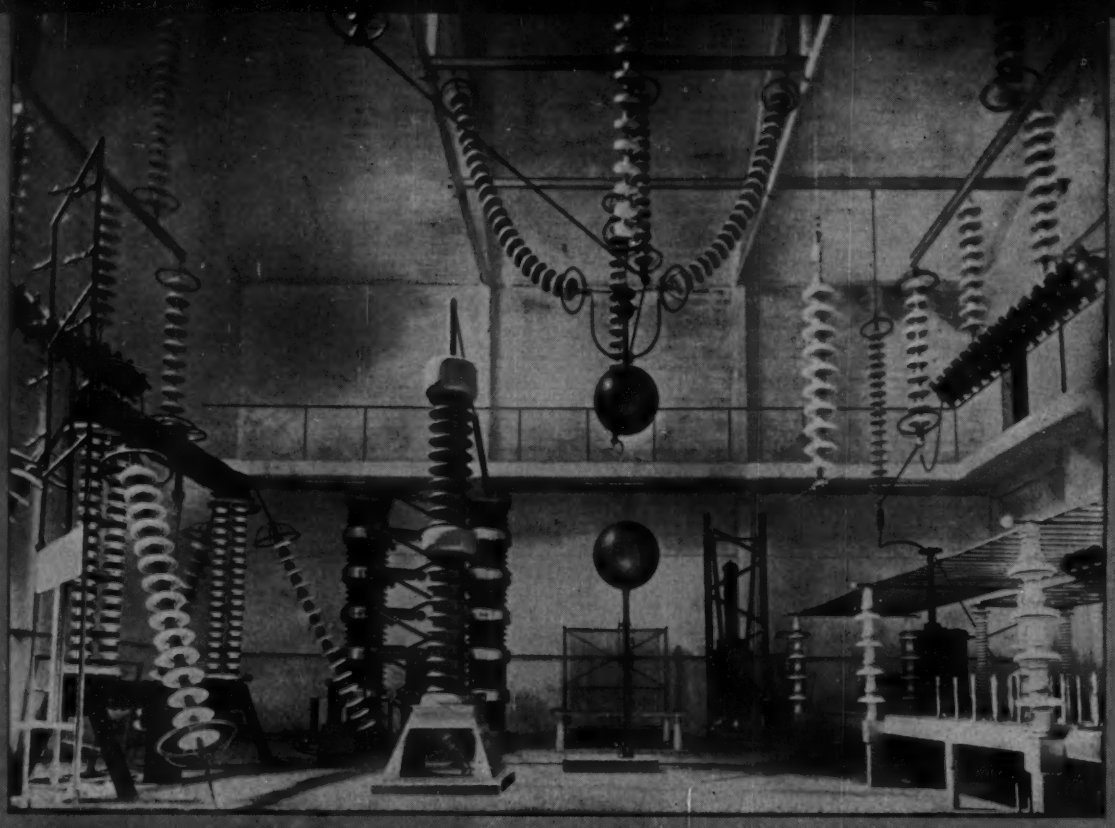
With this novel technique, new transmission ideas are screened in only a fraction of the time formerly required. Thus valuable time and scientific manpower are saved in Bell Laboratories' constant search to provide still better service for telephone customers.

BELL TELEPHONE LABORATORIES

World center of communications research and development

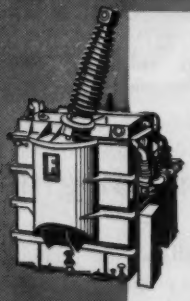
FERRANTI

HIGH VOLTAGE TESTING EQUIPMENT



ARGENTINA

A 1,000,000 volt Ferranti Impulse Generator installed in the Laboratories of Fabrica de Porcelana Armanino, Buenos Aires, Argentina.
This equipment produced the first ever 1,000,000 volt arc in Argentina. Ferranti have also supplied to the same customer a 500,000 volt, 250 kVA, A.C. Testing Equipment.



TRANSFORMER CAPACITY OF OVER 5,000,000 kVA per annum

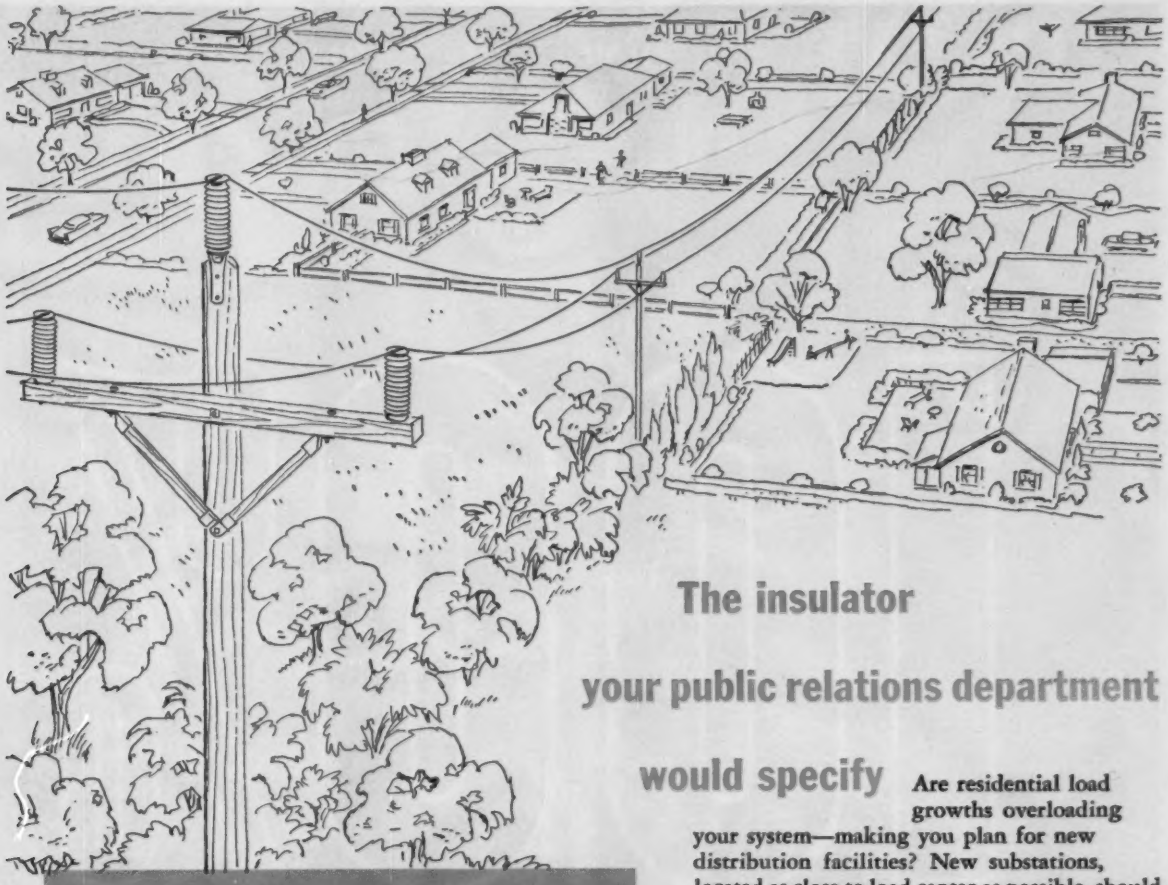
The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI

FERRANTI LTD *Head Office and Plant :* HOLLINWOOD, LANCASHIRE, ENGLAND

OFFICES AND PLANTS

NEW YORK : Ferranti Electric Inc. 30 Rockefeller Plaza, New York 20, N.Y.
TORONTO : Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario.
MANCHESTER, ENGLAND : Ferranti Ltd., Moston, Manchester, 10.
EDINBURGH, SCOTLAND : Ferranti Ltd., Ferry Road, Edinburgh 5.



The insulator your public relations department would specify

Are residential load growths overloading your system—making you plan for new distribution facilities? New substations, located as close to load center as possible, should be your best solution—if sites are available . . . and *if* a subtransmission line through a residential area doesn't encounter customer objection. If you build such a line on large imposing structures, it probably will!

There's a wonderful way to do it, however, and one which will retain customer goodwill! A line up to 69 Kv, and even higher voltages, can go on "small" unobtrusive wood-pole structures, with single cross-arms—and compact, sturdy good-looking Lapp Line Posts. In addition to sparing customer feelings, you'll be saving money, too, in initial cost, and maintenance; service records from coast-to-coast show that such lines for subtransmission voltages are more reliable and trouble-free than any others. And particularly important for lines in residential areas is the fact that Lapp Line Posts are inherently free of RIV and TV interference at rated voltages.

Once you've installed such a line, your future problems diminish. A trim, good-looking, high performance line on Lapp Line Posts serves as a beautiful example of a complaint-free installation. It will be easier to get right-of-way for *future* transmission lines.

Lapp Line Posts, either with tie-wire head or clamp-top, are available in voltage ratings through 88 Kv.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Patent Applied For

Moloney HyperCore Distribution Transformers

Each and every HyperCore Distribution Transformer shipped from Moloney's new, enlarged, streamlined facilities will perform, without exception, as NEMA Standards prescribe! Elaborate test facilities maintained by many utilities are now unnecessary for HyperCore Transformers, because this new manufacturing system eliminates any possibility of shipment of sub-standard transformers. Case histories of *each* individual transformer are kept and *each* transformer must measure up to NEMA Standards and Moloney's own high standards before it can be crated for shipment.

For example—When final assembly is completed, the automatic test system takes over. *Every* transformer must pass the following tests: Copper Loss Test • Ratio Test • Impulse Test • Induced Potential Test • Applied Potential Test • Core Loss Test • Sound Test • CSP Breaker Test (when applicable) • Leak Test.

All these vital tests are made ***automatically*** by remote control from the master control room. It is impossible for the human element to influence tests.

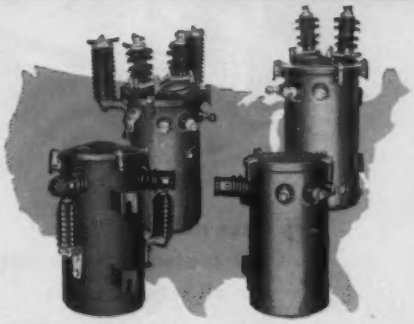
M O L O N E Y E L E C T R I C C O M P A N Y

Automatic spotting devices mark any sub-standard transformer not meeting Moloney's high standards, and direct it into a reject line, where it is removed and examined to determine the reason for failure.

Thus, any HyperCore Transformer that is shipped, *automatically* performs as you, the utility, and we, the manufacturer, want it to perform.

Increased production facilities, plus positive quality control, plus the Moloney network of warehousing facilities, make available the best product . . . at the time you need it. Immediate shipment from stock can be made from a point near you. Check with your Moloney man today.

MES7-6



HyperCore Transformers are available from stock in all Standard Ratings in both Conventional and CSP designs.

MOLONEY ELECTRIC

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

new! always RIGHT FOR ANY BI-METAL OR Al TO Al CONNECTION
WEAVER
PARALLEL GROOVE CLAMPS
ni-cad* COATED!
The weatherproof NICAD coating (over a hi-strength aluminum body) keeps any bi-metal connection troublefree, come what may: Heat, cold, salt, alkali, you name it!
They eliminate trouble caused by... (1) Oxidation of Cu against Al; (2) Unequal expansion or contraction of lines and clamps during severe temperature changes. Contacts stay tight—no arcs.
NO SEPARATE INSERTS TO CATCH MOISTURE AND CAUSE CORROSION! NO SOLDERED JOINTS!
Permanent Low-Resistance Connections
WRITE FOR SAMPLES FOR TESTING
Five sizes now available (NI-CAD coated or non-coated) to cover all requirements.
* Extremely heavy coating of cadmium and other corrosion resistant elements
2110 HOWARD ST. • ST. LOUIS 6, MO. • CEntral 1-8100
J. A. WEAVER Company

Butyrate conduit is joined easily

Using slip-sleeve couplings and solvent cement, two Kingsport Utilities crewmen laid 247 feet of a "white way" line in only 20 minutes—a fraction of the time it would take with conventional materials.

Butyrate conduit curves without fittings

To follow ditch contours in this installation, Brookville Telephone Company, Brookville, Indiana, used semi-rigid conduit of Tenite Butyrate—and eliminated the need for many right angle fittings.

You get extra advantages with conduit of Tenite Butyrate plastic

Conduit made of Tenite Butyrate plastic is ideally suited for your operations.

It has a horn-like toughness and high impact strength. It is unaffected by corrosive and electrolytic action of soil, and is non-inductive. It can be handled, cut and joined with ease. It has glass-smooth walls for easy cable pull-through.

But conduit made of Tenite Butyrate also offers unique qualities not found in any other cable conduit.

It is semi-rigid. This allows the engineer to plan many direction changes—*without fittings*. It is available in long 20-foot lengths to reduce the number of joints in your line. It is extremely light in weight; a length of 4" conduit weighs only 20 lbs.

For more information and the names of manufacturers supplying conduit made of Tenite Butyrate plastic, return the coupon below.

1932—EASTMAN'S 25TH YEAR IN PLASTICS—1957

Butyrate conduit resists corrosion

Tenite Butyrate was chosen by Community Public Service Company as the duct material to successfully combat the strong alkali soils found in the Pecos, Texas area.

TENITE
BUTYRATE
an Eastman plastic

EASTMAN CHEMICAL PRODUCTS, INC.
subsidiary of Eastman Kodak Company, Kingsport, Tennessee

Please send me information on cable conduit made of Tenite Butyrate and a list of companies manufacturing Butyrate conduit and fittings.

NAME_____

POSITION_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

5-10 TC @ 6 IN. 35 X 72

COOLING DATA-	OA	FA
RISE GUARN.	55	
GRADIENT	7.972	
AVG. OIL	44.02	
CONV. COEF.	.1450	
RADN. COEF.	.2164	
TUBES/RAD COEF.	.1408	
CONV. WATTS	3477.694	
RADN. WATTS	8786.892	
TEMP. RUN WATTS	33402.84	
DISSIPATED WATTS-		
NEEDED TUBES/RADS.	21138.26	
ACTUAL TUBES/RADS.	21260.96	

FANS-	FOR RADS.	FOR TUBES
ON BACK		
ON EACH END		
ON FRONT		

WEIGHTS-	
CORE AND COIL	
LBS LIQUID	
WALLS/BRACES	
COVER/BOTTOM	
TUBES	
FANS/EQUIP.	
RADS.	
FANS/EQUIP.	
BASE	
EXP. TANK	
CASE AND FTGS.	
TOTAL TRANS.	
LIQUID- GALS.	
TOTAL GALS.	
TRANS. TANK	
EXP. TANK	

KVA 3750 H.V. 22900 DELTA L.V. 4160 W

IBM 705 CONSOLE

Helping the industry meet its growing loads

This machine advances tomorrow's developments

Time is of the essence to solve the intricate design and application problems consuming enormous amounts of engineers' time.

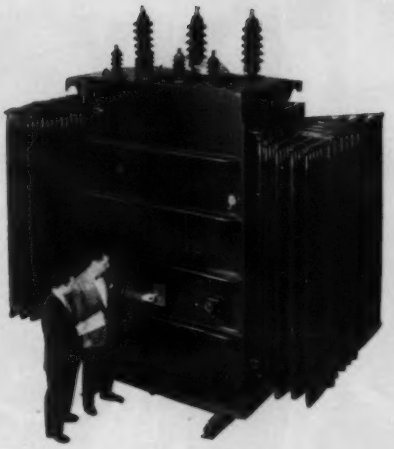
For this reason, Westinghouse has invested heavily in the design of power transformers by electronic computers. This automated designing is freeing dozens of engineers from millions upon millions of mechanical computations. As a result, Westinghouse creative design capacity and long-range development are greatly expanded. The result . . . creative engineering progress.

Look for new materials and years-ahead methods of construction from Westinghouse. This, combined with new ideas, will produce better products which can be translated into money savings for you. From pioneering ideas at Westinghouse, look for equipment that will help you keep the cost of electricity the consumer's biggest bargain.

J-97202

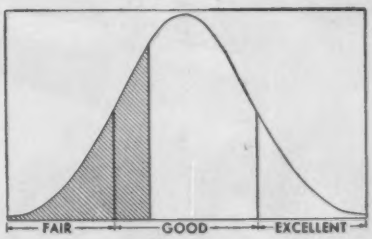
YOU CAN BE SURE...IF IT'S

Westinghouse



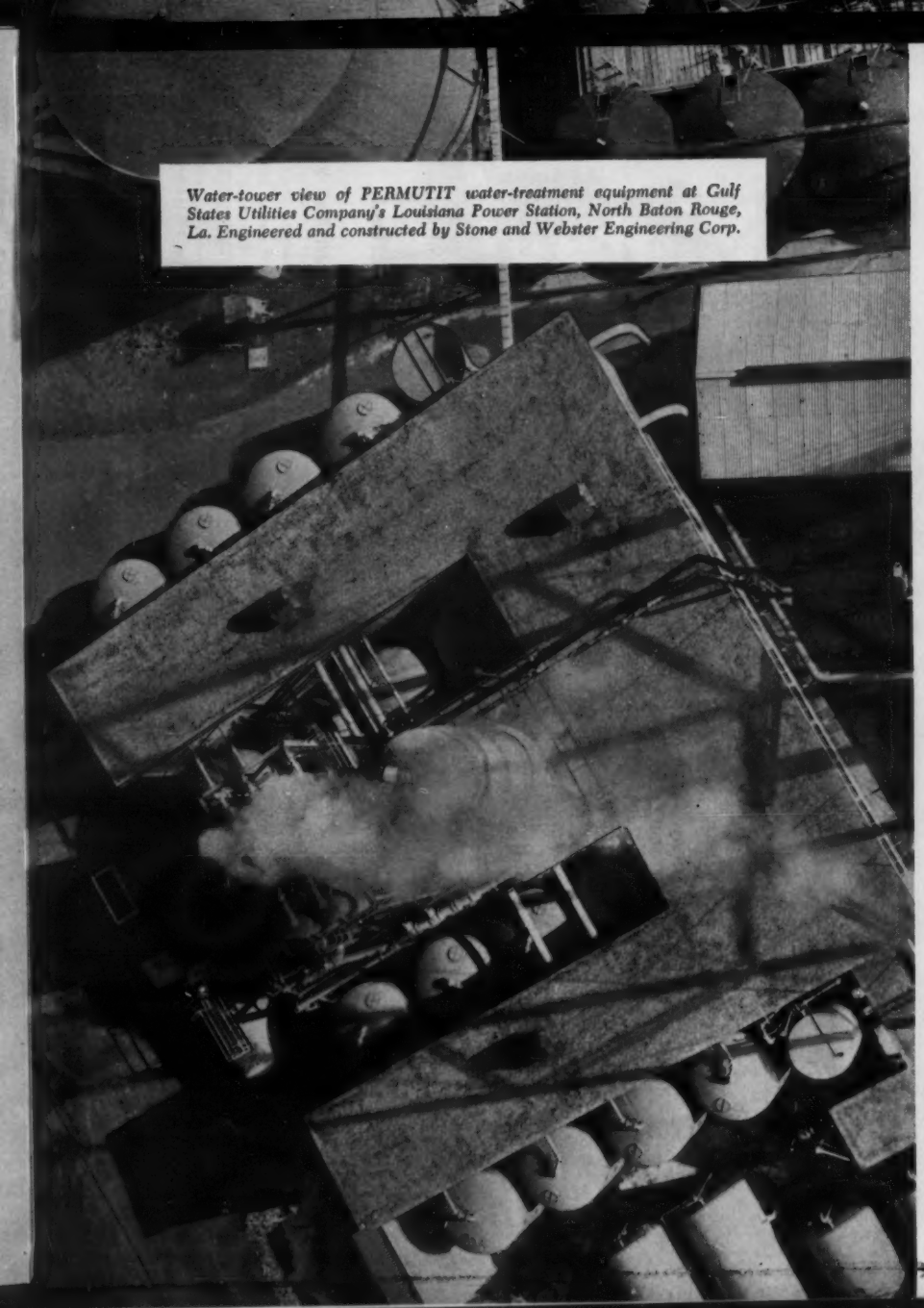
Designed with electronic computers

In addition to rating, complete performance data was loaded into the machine—impedance, iron loss, total loss, exciting current, temperature rise, sound level and many other variables. The computer made the necessary calculations of physical quantities and proportions of iron, copper and insulation. Tank dimensions, cooling requirements and other factors were all calculated to bring the design to optimum standards. Human error was eliminated.



Distribution of design quality . . . shaded area is eliminated in computer design

Electronic computers have reduced transformer design time from two weeks to four minutes. Coupled with this is the machine's unusual genius of being able to produce optimum designs consistently . . . equal to designs of top engineers with unlimited time.

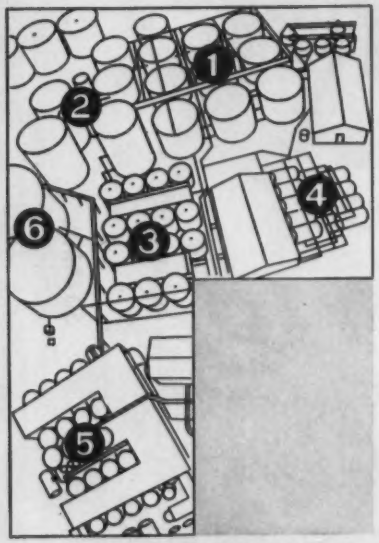


Water-tower view of PERMUTIT water-treatment equipment at Gulf States Utilities Company's Louisiana Power Station, North Baton Rouge, La. Engineered and constructed by Stone and Webster Engineering Corp.

12 million gallons of make-up per day

This station needs a *large volume* of water because it sells its steam to a refinery for process and requires 100% make-up. It needs *high-grade* water because it has adopted high-pressure boilers and turbines. It needs *efficient* treatment because it uses muddy Mississippi River water and well water with high solids and silica.

HERE'S HOW THIS 26-YEAR OLD PLANT HAS KEPT UP TO DATE *(see diagram):*



1. Original *batch coagulation and settling tanks.* Some are still used for secondary treatment of river water to reduce silica.

2. The 1931 roughing sedimentation tanks were converted to modern up-flow *Precipitators* in 1938 . . . cutting hardness 20%, turbidity 40%—and tripling capacity.

3. *Gravity filters* polish the clarified river water prior to softening.

4. Old Zeo-Dur® *zeolite softeners* were converted to new Zeo-Karb® exchanger in 1937 . . . boosting each unit's capacity 55%.

5. *Demineralizers* for new high-pressure boilers were added in 1955. They treat 3500 gpm, reduce dissolved solids of well water from 271 to under 2.0 ppm and silica from 25 to less than 0.1 ppm. Completely automatic PERMUTIT controls determine end-points, rinse, backwash and regenerate units and return them to service . . . even prepare regenerating solution.

6. *Tanks* store the high-quality, low-cost demineralized feedwater.

Whether you need one piece of water-treatment equipment . . . or acres of it, PERMUTIT has the know-how . . . earned by experience. This knowledge is at your service. Write The Permutit Company, Dept. EW-6, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

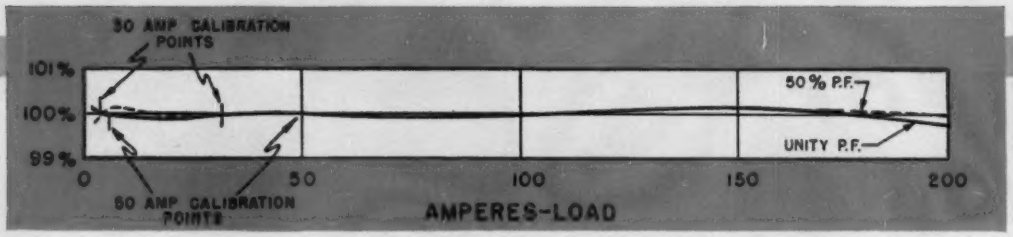
PERMUTIT®
WATER CONDITIONING
Equipment • Resins • Experience

Demineralizers • Zeolite and Hot-Process Softeners • Dealkalizers • Deaerating Heaters • Pressure and Gravity Filters • Chemical Feeders • Aerators • Blow-off equipment • CO_2 Indicating Recorders • Zeolites and Resins • Instrument Panels • Control Cubicles.

CLASS 200 TYPE MK for More Housepower

50 AMP.

30 AMP.



The Duncan Type MK Class 200 meter is the latest of the improved singlephase MK line, built to accurately meter a wide range of loads from a few watts to the meter's full 200 ampere capacity. Arc-resistant insulation in the electromagnet, self-contained arc gaps to by-pass electrical disturbances, and Alnico V permanent magnets to maintain calibration stability are just a few of the MK features in this meter.

Duncan pioneered the Class 200 rating with the Type MF-SE meter introduced eight years ago. This new MK offers improved performance, *plus* all of the features of the Duncan MK singlephase line. Both the 30 ampere and 50 ampere Duncan Type MK meters have a K_h of 12 and run at the same speed per ampere. As with all Duncan meters, a minimum light load safety factor of 2% is provided to avoid creep. Average starting watts is ⅓ of 1% of rated load.

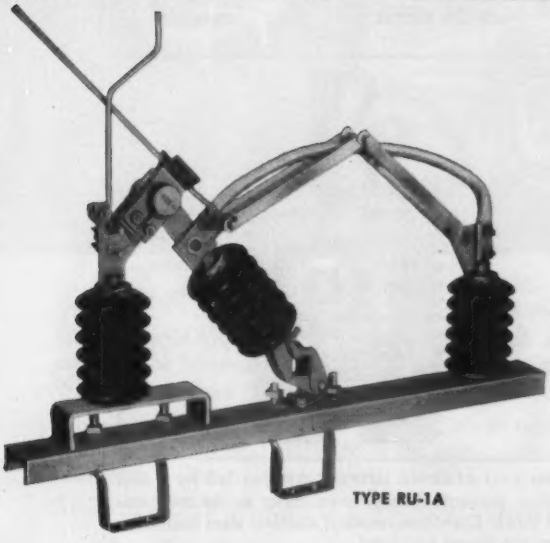
Duncan Class 200 meters, being of relatively slow speed, provide an excellent load curve as illustrated above.

LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER

DUNCAN ELECTRIC CO., INC. LAFAYETTE, INDIANA

For low-cost switching choose a Southern States tilting insulator disconnect

TYPE TR-1A



TYPE RU-1A

TWO COMPLETE LINES

When easy, low-cost installation is the first requirement for disconnecting switches, Southern States offers you not one—but two complete lines from which to choose.

The Type TR-1A is a high-quality rocker-type disconnect that meets NEMA Standards in every respect. It is available in voltage ratings from 7.5 kv through 69 kv and continuous current ratings of 200, 400, and 600 amps.

The Type RU-1A is a distribution level tilting insulator switch specifically designed for pole-top mounting. Its dielectric strength is the same as standard levels for other distribution equipment, but it is below NEMA Standards for power switching equipment. It is available in voltage ratings of 7.5 and 15 kv and continuous current ratings of 200 and 400 amps.

Both types are ruggedly constructed, and will provide reliable switching under all service conditions. Many utilities throughout the nation have found in these switches the answer to their needs for low-cost, easily installed disconnecting switches. So can you. Get full details in our Bulletins 54 RU and 3050.

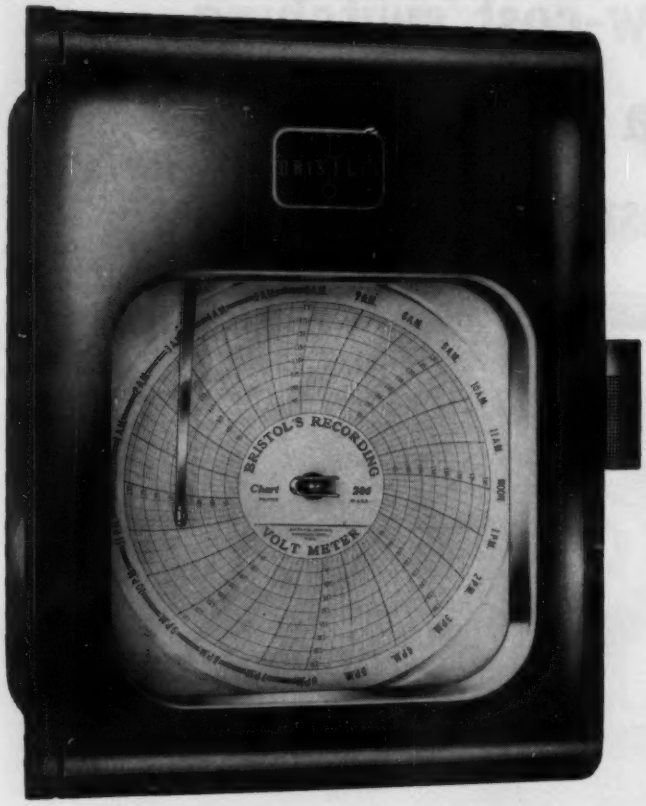
EASY INSTALLATION

One reason utilities find the installation of these switches so easy is the method for affixing the interphase shaft to the rocking insulator. The shaft is laid in its proper position across all three phases and then only one bolt per phase is tightened to complete the installation, saving valuable installation time in the field.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

WHAT'S NEWS AT BRISTOL . . .



PERMANENTLY MOUNTED Bristol Voltmeters and Ammeters come in three models: interchangeable surface and flush, surface-panel, and flush panel.

How do you pick the right recording ammeter or voltmeter?

The *right* choice for any voltage or current measurement and recording job is a Bristol Series 500 instrument.

Why Bristol? Mainly because for sheer accuracy the Bristol Recorders can't be topped. Among the reasons for that are:

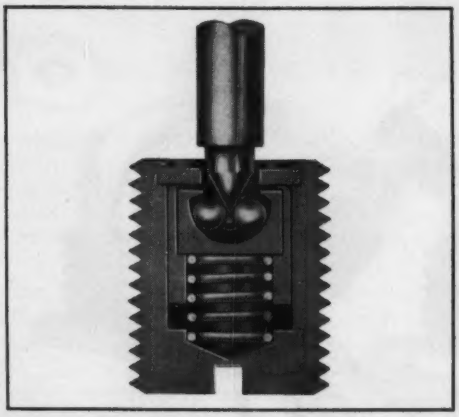
1. Low burden – the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes – up to full scale value.

Also, Bristol's Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof cases; quick-set chart hub for each chart changing; and snap-on chart plate.

Models offered that comply with ASA Specification C39.2.

Want more facts? Write for Bulletin E1111 to the Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 5.19

SINGLE AND TWO-PEN PORTABLE BRISTOL RECORDERS are offered in two models: one chiefly for portable pole mounting and the other for general portable service.



NEW BALL-BEARING SUSPENSION, loaded by a coil spring, prevents damage even under severe mechanical shock. Corrosion-resistant stainless steel ball bearings are almost tool-hard.

BRISTOL

TRADE MARK BRISTOL'S REG. U.S. PAT. OFFICE

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

ANOTHER REASON WHY UTILITIES EXPECT MORE FROM

POWERS *American*

Setting the pace...

Pole-Master®

HYDRAULIC DERRICKS

3 MODELS...7 SIZES

You just can't beat the cost-cutting convenience of Pole-Master. At the flick of a lever, powerful hydraulic cylinders move the derrick to the position that's *exactly* right for the hoisting job. There's no exposed mechanism. Head sheave can be threaded from the ground.

When it comes to capacity, Pole-Master equals or surpasses conventional derricks of comparable rating. It stows *above* the body... never obstructs valuable cargo area space.

Aren't these the features you've long wanted in a derrick for your job?

The powerful Series PM-2 Pole-Master, shown above on a Powers-American Series 800-C Line Body, is available in sizes for handling 40′, 55′, and 70′ poles.

DESCRIPTIVE LITERATURE ...plus complete price information IS YOURS FOR THE ASKING!

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.

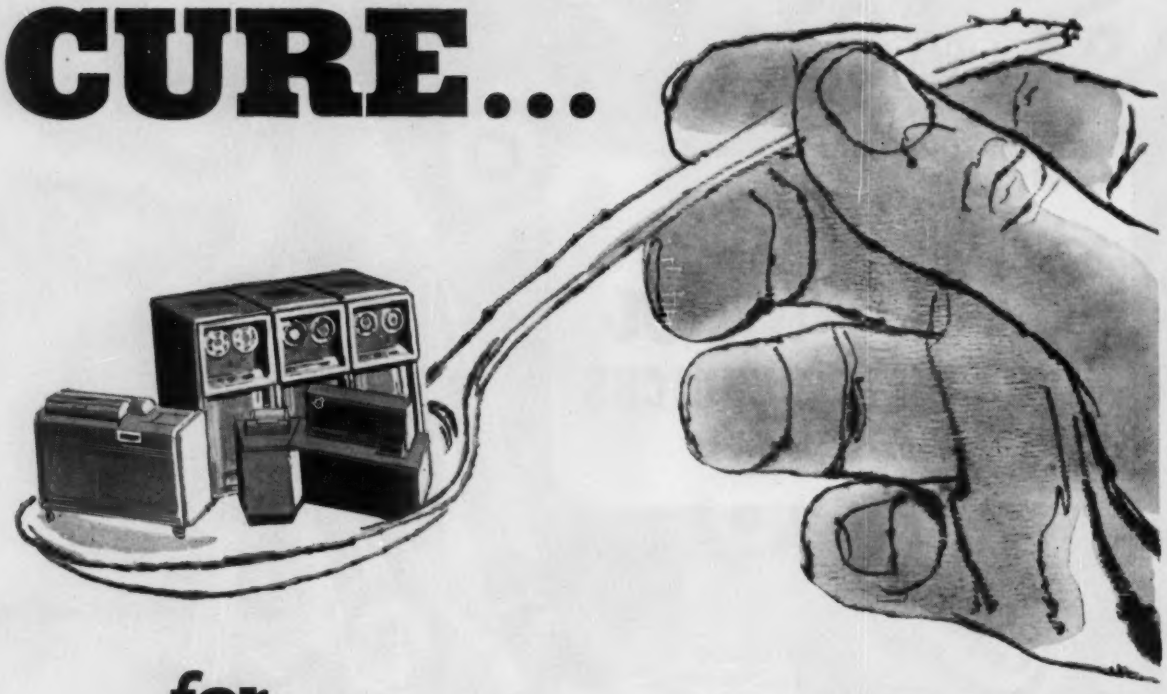
625 CEDAR ST. • BERKELEY 10, CALIF.

Series HD-2 Pole-Master Derricks can be furnished in sizes for handling 40′ and 55′ poles.

The Series HD-4 Pole-Master, actuated by four hydraulic cylinders, handles 55′ and 70′ poles.

Powers-American conventional derricks, tripod or T-type, are available in all sizes and capacities.

CURE...



for public utility growth problems

• To keep service up . . . and costs down . . . in today's rising tide of public utility growth, more and more companies depend on the speed and accuracy of IBM electronic data processing systems to eliminate growth problems.

• One large utility company, for example, has already saved some $70,000 on payroll and stock dividend applications through the use of its IBM 705.

• In the face of your growth, too, IBM systems not only maintain the great service tradition of public utilities, but actually smooth out procedures . . . step them up. Moreover, they can solve your complex engineering problems, freeing valuable engineering talent for more creative work. And expanding customer billing, payroll, other routine accounting jobs are done more easily, swiftly, accurately.

• Whether your problems are in accounting *or* engineering, your IBM representative brings the full weight of IBM's 43 years of experience and *proven* performance to bear on them. Why not phone him today? Or write: Public Utilities Department A57, International Business Machines Corporation, 590 Madison Avenue, New York 22, New York.

IBM DATA PROCESSING

- DATA PROCESSING
- ELECTRIC TYPEWRITERS
- TIME EQUIPMENT
- MILITARY PRODUCTS

This Pneu-Draulic operated breaker is mechanically trip-free for positive protection

Get more positive protection with Allis-Chalmers mechanically trip-free breakers

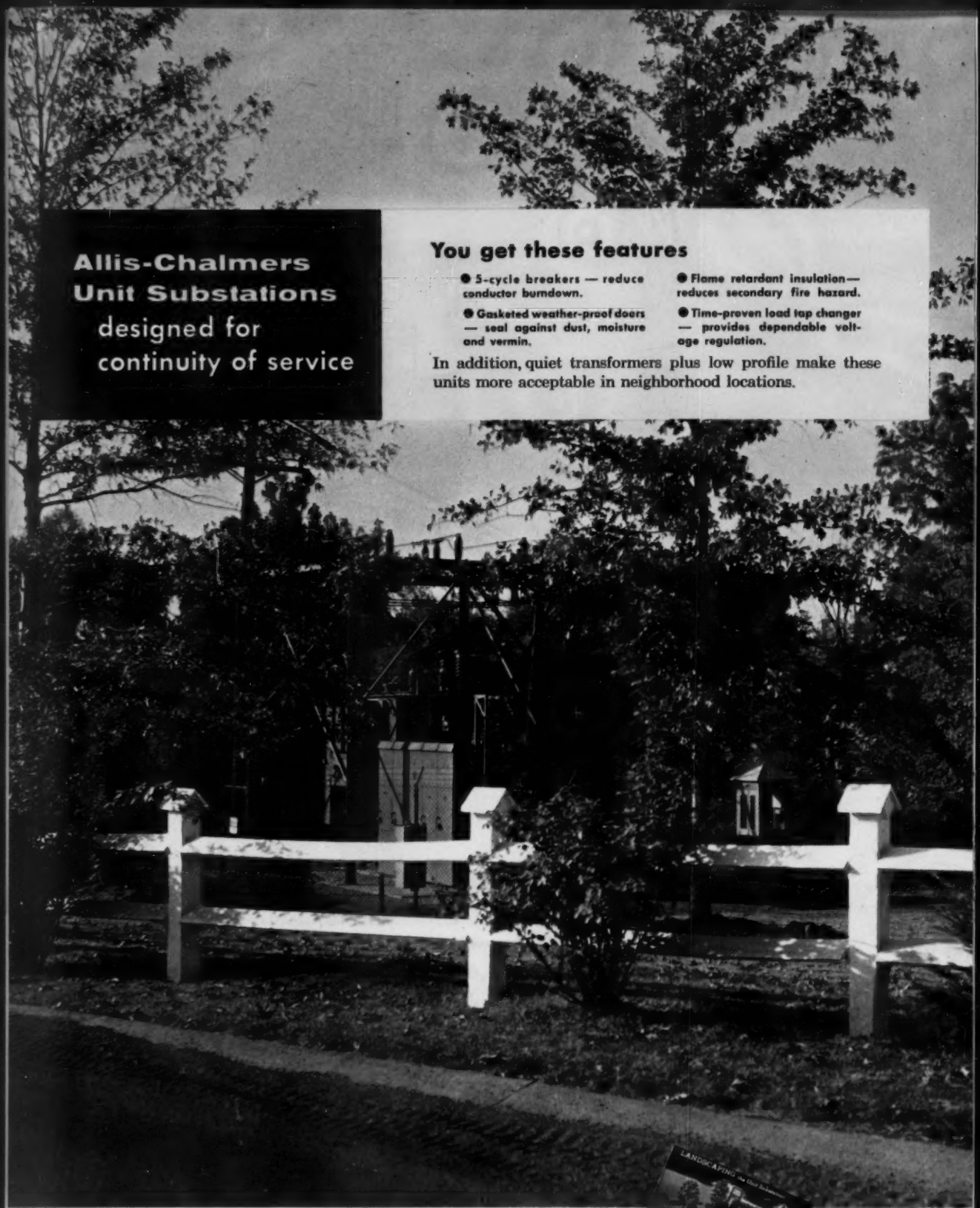
Contacts are always free to open at full speed in Allis-Chalmers mechanically trip-free breakers. Contacts and closing mechanism are always completely uncoupled during tripping operation, enabling contacts to open without restriction from mechanism. Breakers that are only pneumatically or hydraulically trip-free cannot give you this protection.

Pneu-Draulic is an Allis-Chalmers trademark.

Get details on this and other features of Allis-Chalmers breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-5242



Allis-Chalmers Unit Substations designed for continuity of service

You get these features

- 5-cycle breakers — reduce conductor burndown.
- Gasketed weather-proof doors — seal against dust, moisture and vermin.
- Flame retardant insulation — reduces secondary fire hazard.
- Time-proven load tap changer — provides dependable voltage regulation.

In addition, quiet transformers plus low profile make these units more acceptable in neighborhood locations.

A-5258

Ask for Bulletin 1187912

For help on your substation problems, call on A-C specialists. Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS *for progress in switchgear*

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RCA Microwave Radio Systems are designed with future needs in mind. They do not face obsolescence because of users' growth. High channel capacity permits orderly growth up to a total of 120 channels for voice, data transmission, supervisory control and other purposes.

RCA was one of the earliest pioneers in the development of microwave for commercial communications. Today, RCA Microwave Systems provide users throughout the world with many important features . . . operation in the most advantageous frequency bands, simplified installation and minimum maintenance cost.

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More than a million channel miles of RCA Microwave Systems in service . . . performance proved throughout the world.

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SPECIAL NOTE TO RCA CUSTOMERS:

Ask about the RCA "Package Expansion Plan" which confirms your wise choice of RCA CW-20 or MM-26 Microwave for your communications system. A minor field modification will bring your system up to 48, 72 or even 96 channel capacity, depending on your revised requirements.

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We have RCA_____Microwave.

☐ Send latest literature on RCA Microwave Radio for use in _____

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(PLEASE PRINT)

COMPANY_____

ADDRESS_____

CITY_____ ZONE___ COUNTY_____ STATE_____

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RCA Tmk(s) ®

RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS

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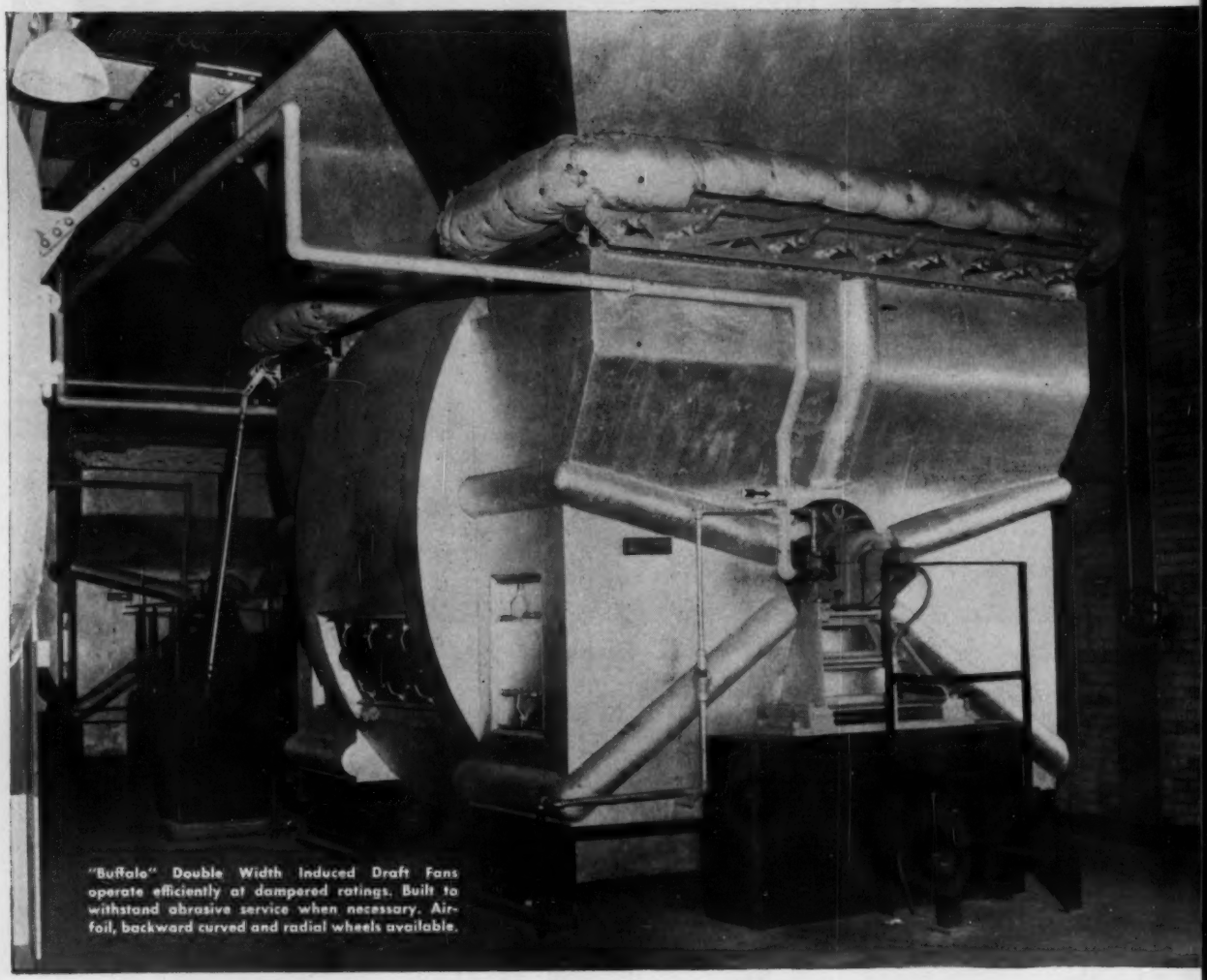

"Buffalo" Double Width Induced Draft Fans operate efficiently at dampered ratings. Built to withstand abrasive service when necessary. Airfoil, backward curved and radial wheels available.

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Pacing the airfoil's rise to popularity for mechanical draft service, the "Buffalo" Airfoil offers many unique design and construction

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- Extra-wide airfoil blades with tips to full channel width — for extra-deep "bite".

TYPE "BA", the basic wheel design for mechanical draft applications.

TYPE "CA", for conditions of higher pressure and lower capacity.

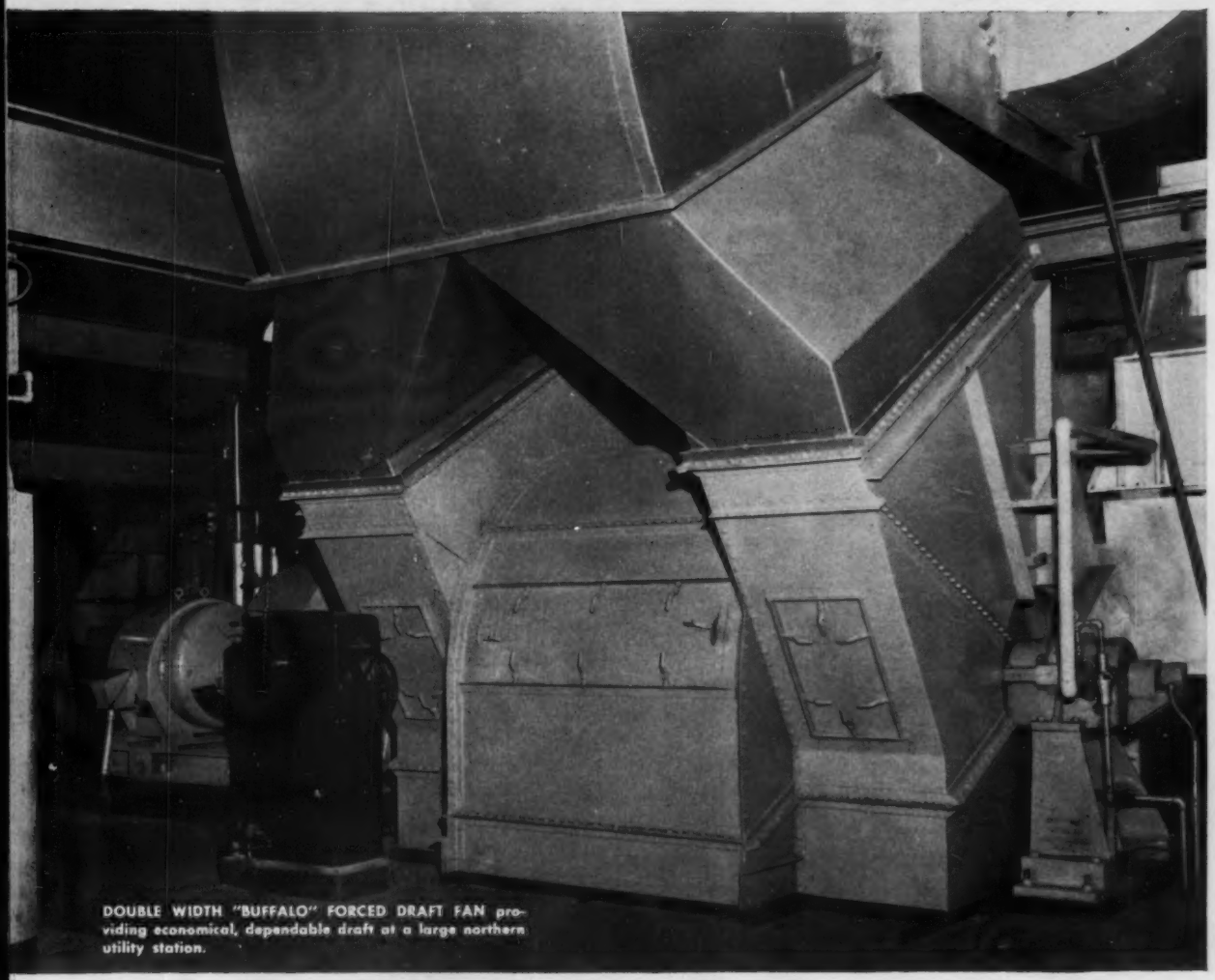
TYPE "AA", for lower pressures and higher capacities.

TYPE "CLM", one of 3 semi-airfoil wheels approaching performance of full airfoil wheels.

THE COMPLETE "BUFFALO" AIRFOIL SERIES TO MATCH ALL SPECIFIC OPERATING CONDITIONS

All wheels variable as to width for exact match of pressure-volume requirements with no sacrifice in efficiency. If you are interested in the finest draft service, write today for Bulletin FD106.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT



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MECHANICAL DRAFT REQUIREMENTS

features found in no other fan. By combining modern fan engineering with traditional "Q" Factor* construction, "Buffalo" has given the industry an airfoil fan offering these important features:

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ANACONDA ACSR was installed over large segment of Duke Power Company's 75-mile,

ACSR? Put Anaconda's 50 years of trans-

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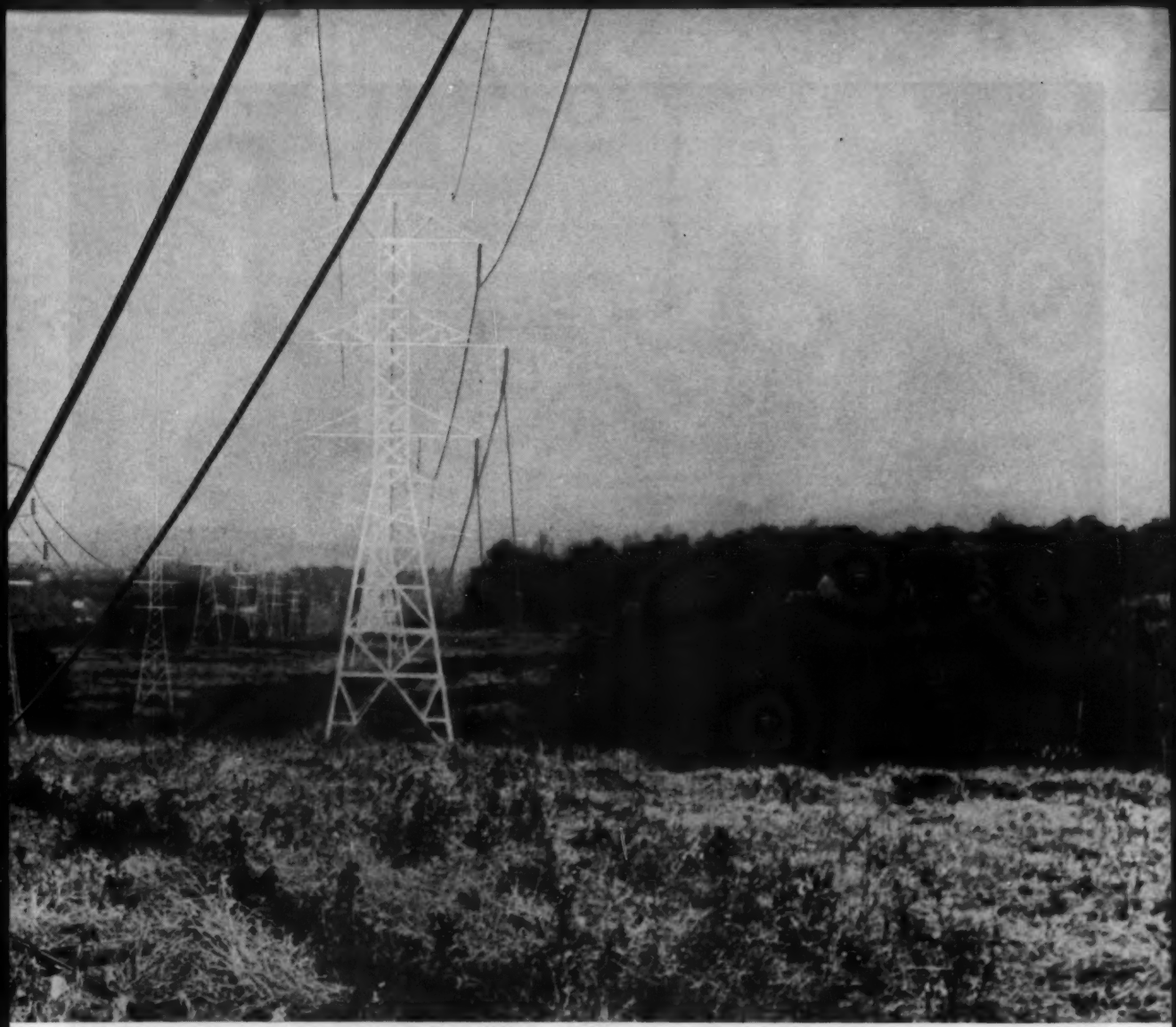

230KV Riverbend-Tiger Line. Here, you look west of Kings Mountain, S. C.

mission cable experience to work for you

Producing top quality transmission cable requires more than a ready supply of metal—copper or aluminum. The most vital ingredient of good cable is the manufacturer's *cable experience.*

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Backed by the broadest line of wire and cable in the industry, in both copper and aluminum, he is best qualified to help you arrive at the most practical and economical answer to your cable needs.

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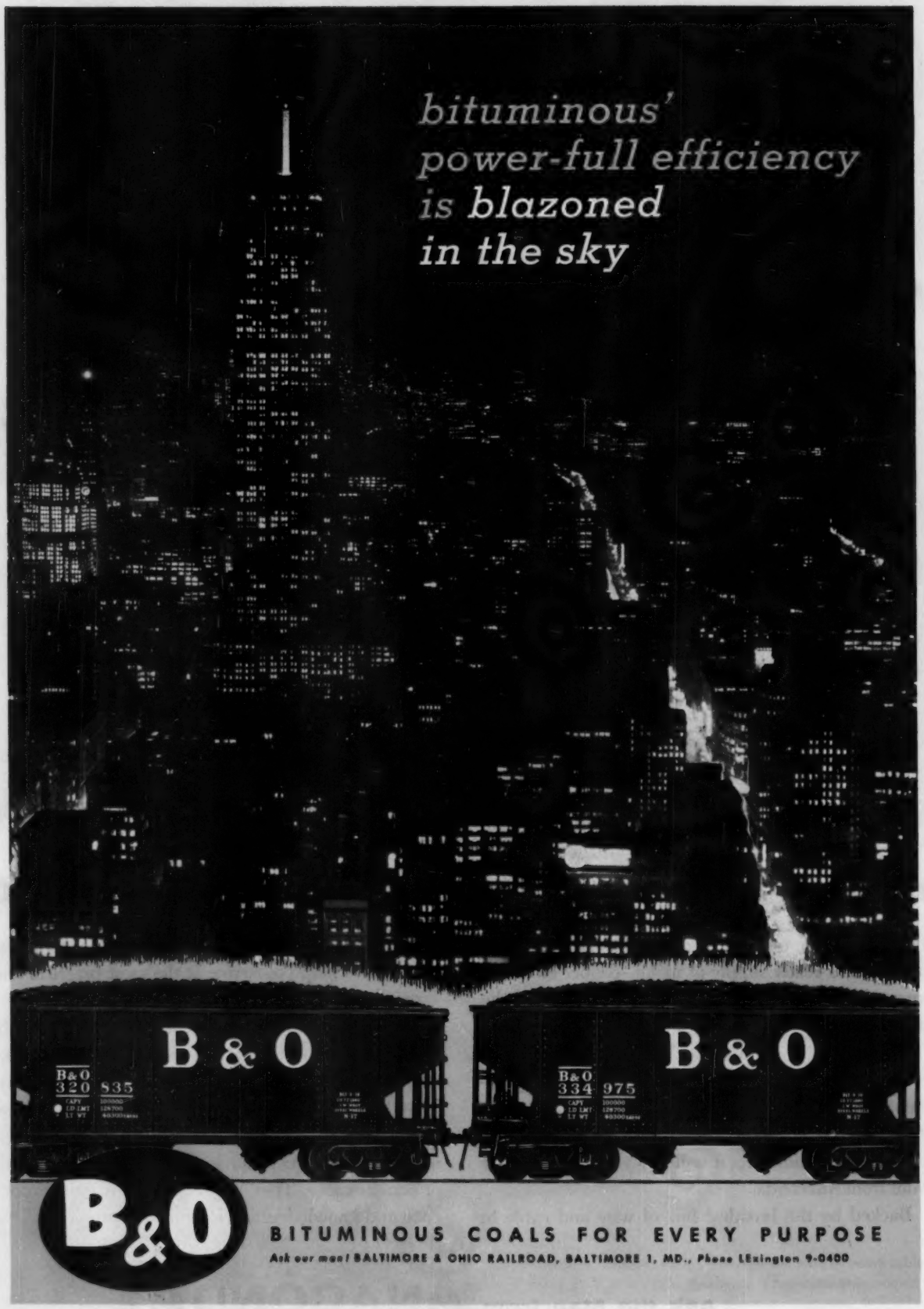
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Those holes in Chase ventilated copper bus are like money in your pocket! Allow cooling air to circulate through the interior of this rugged conductor. Result? Lower operating temperatures that enable Chase ventilated bus to carry *20 per cent more current* than ordinary bus with the same dimensions!

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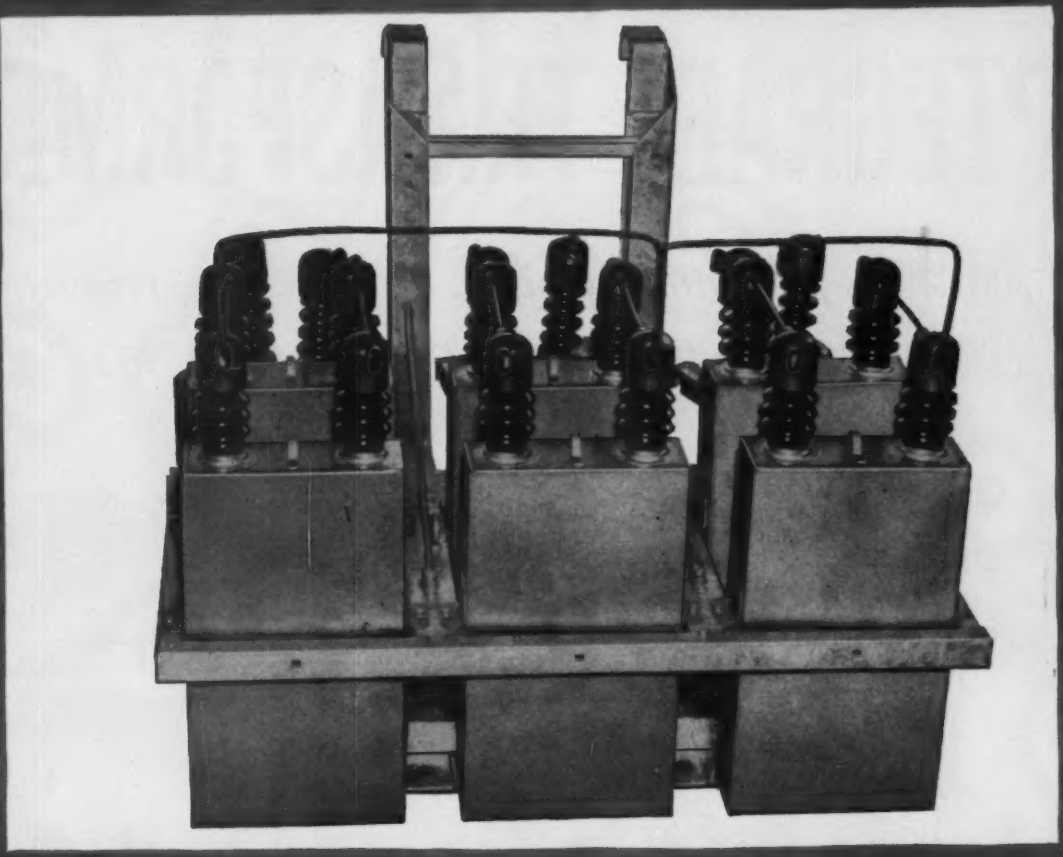
CHASE ELECTRICAL CONDUCTORS
are available in a variety of shapes to suit every power-carrying need.

Big things come in smaller packages from TOBE



IN SOME BUSINESSES, the bigger the package the bigger the sales. People say *"bulk it up . . . make it look big"*. Our business is different. *"Shrink it"*, we say. Our engineers are experts at making capacitors smaller in everything but performance. The TOBE 50 KVAR power capacitor is a case in point. As a result of TOBE's progressive engineering design, rigid production controls and test procedures, this 50 KVAR delivers twice the KVAR rating in only 40% the size and weight. That is why it will pay you to investigate the new line of TEMPALL POWER CAPACITORS.

TOBE TEMPALL CAPACITORS *also feature*:

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Available in all standard ratings. In single units, racks, pole assemblies and complete cabinets ready for installation. Write to Tobe Deutschmann Corporation, Norwood, Mass. or phone Norwood 7-2620, collect.

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TOBE

TEMPALL CAPACITORS

In this new AMERICAN METER COMPANY plant...

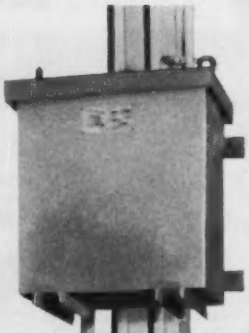
UPTEGRAFF TRANSFORMERS

provide: *dependable design, quality construction, efficient operation, overall economy*

The American Meter Company has ten plants throughout the United States where pressure-measuring meters for water and gas are manufactured. The above new plant is a typical example of how Uptegraff transformers efficiently and with maintenance-free long life serve important industries as well as utilities.

The transformers range from 1000-kva outdoor power transformers, seen on the next page, to the indoor dry-type transformers, below, both overhead and floor mounted. The main outside bank of Uptegraff transformers connects to Philadelphia Electric Company's 33-kv lines. This high voltage is permitted for the use of the industrial company. It reflects the high degree of confidence of the American Meter Company in the design and construction of Uptegraff transformers.

Uptegraff makes a complete line of Power, Load Center, Distribution—overhead and station type, Network, Instrument, and Specialty transformers. Write for Engineering Data *today*.



A typical Uptegraff indoor specialty transformer for overhead mounting. Made by the Terra Alta Division, this dry-type transformer is rated at 30 kva.

R. E. UPTEGRAFF MANUFACTURING CO.

Scottdale, Pennsylvania

Architects and Engineers
George M. Ewing Co.
Philadelphia, Pa.

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General Contractors
Nason and Cullen, Inc.
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Electrical Contractor
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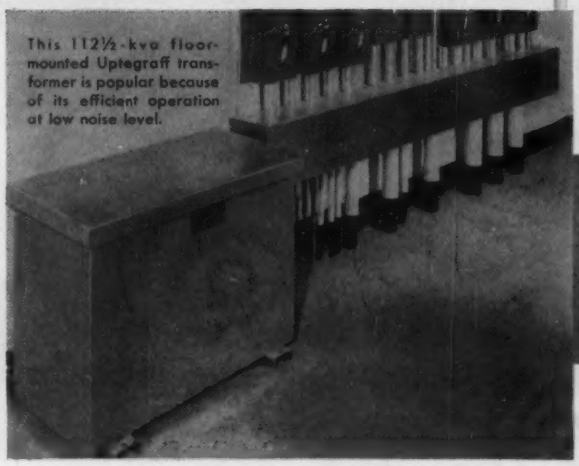
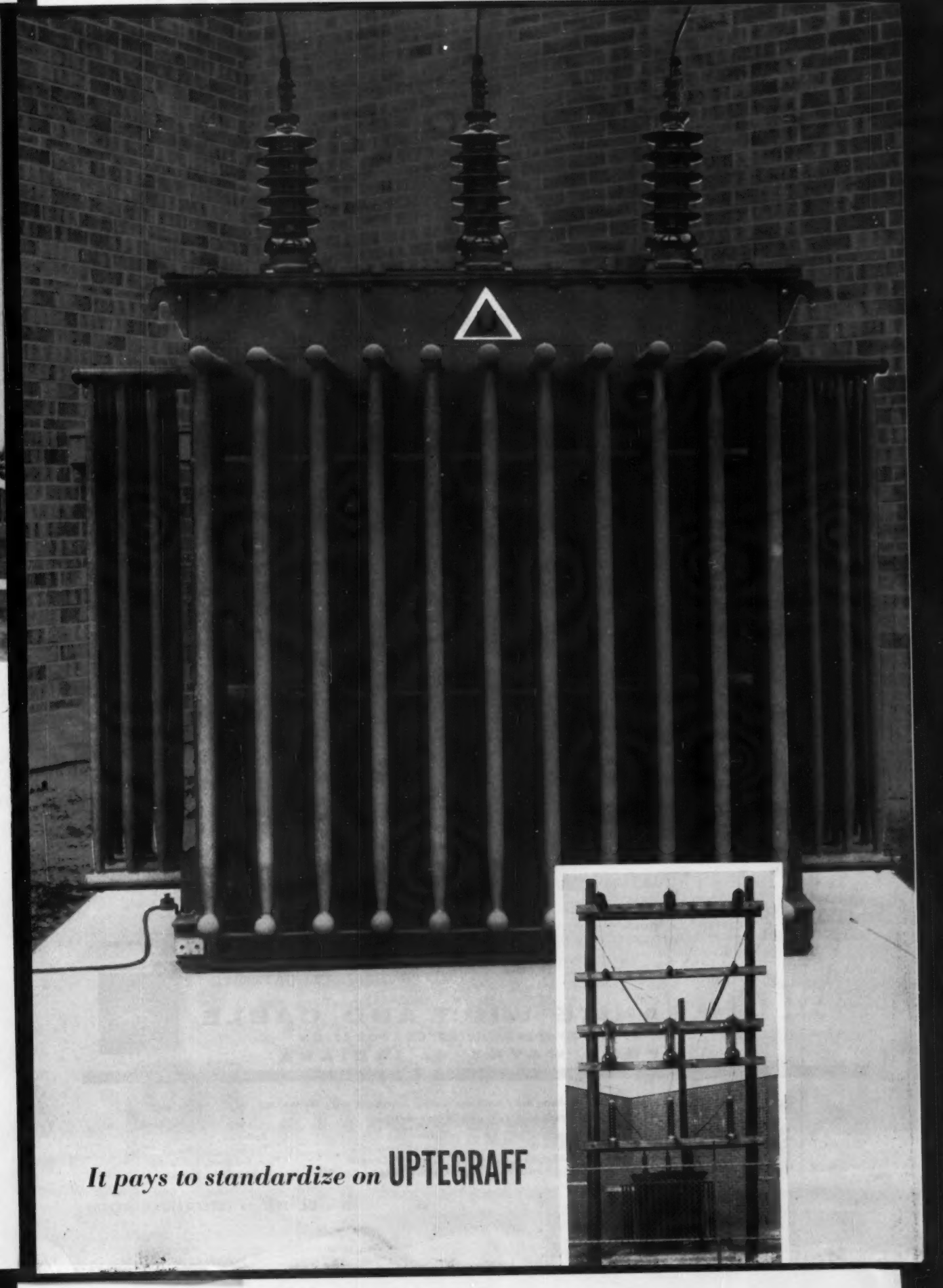


This 112½-kva floor-mounted Uptegraff transformer is popular because of its efficient operation at low noise level.



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From Power to Control Cable...

Cable specified for utility applications must provide dependable performance to the highest degree. That's why more and more engineers are saying—If It's Paranite It's Right!® Paranite cable is engineered to perform in excess of your most rigid requirements. Super-Pararite® butyl rubber insulations have been developed to withstand special conditions in your area. Copper or aluminum bare or weatherproof cables—ACSR or line wire (formerly products of Midland Wire Corporation) are available.

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Included are comprehensive data presented in handy reference form, typical performance curves and a handy ratio-phase angle correction chart.

Single or quantity copies are yours for the asking. Write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Allis-Chalmers Instrument Transformers Available in Over 400 Ratings

Name the application. There's an Allis-Chalmers instrument transformer that fills the bill precisely. Indoor, outdoor, dry-type, oil or compound-filled units — they are all available in the widest possible rating range.

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A-5386

A question for every electric utility

JUST HOW FLEXIBLE CAN POWER SUPPLY GET?

Giant strides to improve flexibility of supply to customers have been taken in recent decades by the electric utility industry. Today power availability must anticipate load growth more than ever before. Inter-connected supply permits transferal of power from one area to another as varying geographical load demands or emergency situations arise.

Even greater flexibility, however, can be attained—by means of Electro-Mobile Power. Truck-trailer or rail units permit shifting increments of power from place to place as demands change. Units can be used singly or in multiple—added like building blocks to match requirements exactly. And provision for impulse starting and stopping allows unattended operation from any location in the system.

Moreover, the placement of Electro-Mobile Power close to the load not only relieves the central station of a block of power, but also reduces the line loss between the central station and the load for that block of power. This is a major factor at time of peak.

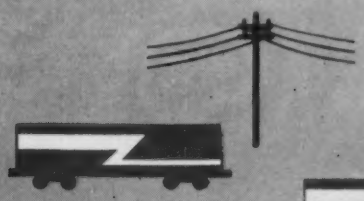
Just how flexible can service get? Far more flexible than you might imagine with present equipment if Electro-Mobile Power is employed to answer additional requirements. A joint analysis of your system can reveal the savings and increased flexibility possible with these units. Contact your Electro-Motive representative for full information.

Electro-Mobile Power adds to system flexibility in many ways

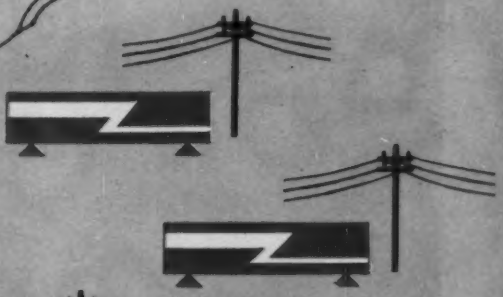
RAIL CAR—1000 kw units for use on sidings or placed on piers for semi-permanent use.

TRUCK TRAILER—500 kw units offer excellent mobility for many temporary applications.

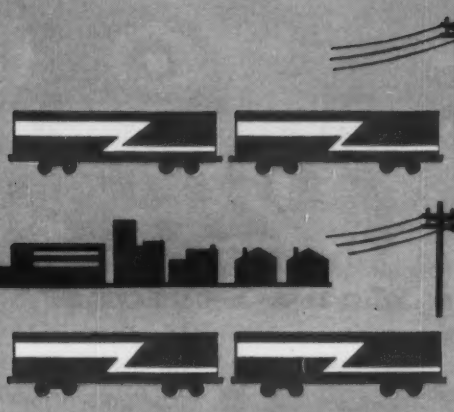
Representative electric utility companies across the country are now providing better service to customers through the use of Electro-Mobile Power. This diagram is a composite of the different jobs these units, both truck-trailer and rail, are performing. Detailed information on these applications—operating costs, KWH produced, reason for use, location, etc.—are available through your Electro-Motive representative.



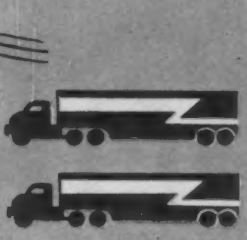
Rail units used for boosting.



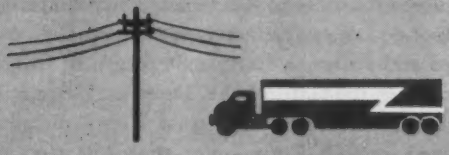
Rail units used for peaking.



Rail units used for temporary service during growth stage of new community. Units are added or subtracted until level is reached and permanent facilities can be erected in the most desirable location.



Mobile trailer units thrown into service during temporary outage caused by flood.



Mobile trailer units being used during line relocation resulting from new highway construction.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS LA GRANGE, ILLINOIS
Sales Offices in Chicago, New York, St. Louis, San Francisco

"Time Teaches Many Lessons" *

*Aeschylus 540 B. C.

Ferdinand de Lesseps:

de Lesseps vision, the Panama Canal, inspired American engineers to titanic efforts—making the idea a reality. Tropical climate and terrain took a heavy toll in men and materials. But the lessons learned by a generation of canal builders—from 1882 to 1914—have never been forgotten.

In 1908, fifty miles of Kerite cable helped speed the completion of de Lesseps tremendous venture. Laid over jungle swamps and scarps, a thirty-mile length of this cable was submerged in the Gatun Lake. Based on the unfailing operation of the first cable, a second Kerite installation was completed in 1918. Time—more than 100 years of it—has taught successive generations of Kerite engineers that there can be no compromise with quality or integrity.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston; 4101 San Jacinto, Houston 4, Texas; 1010 Euclid Avenue, Cleveland 17, Ohio; 29 West Lancaster Avenue, Ardmore, Pa.

How Far Can EEI Go?

Electric companies, as a national industrial group, must face up to several important challenges during the year ahead. The nature and scope of these challenges are described by Donald S. Kennedy, president of Edison Electric Institute, and J. Wesley McAfee, vice president, in exclusive interviews which lead off our special EEI convention report in this issue (pp 97-112).

A study of these two interviews with men entering their second terms in the top EEI posts disclose not only the problems ahead, but the limited role which EEI will play in meeting these problems and challenges. EEI member companies must now decide whether their national association has sufficient authority and resources to cope with these problems.

There was a wide area of agreement between Kennedy and McAfee as to the major electric company problems although the interviews were conducted separately and the men were subjected to different questions. This is the way they see it:

- Electric companies must do more to gain a favorable public understanding of the power business.
- Electric companies and their national associations must supply the public the facts and figures on the federal government power issue and explain them in terms that the layman can comprehend.
- Electric companies must step up their selling and promotion efforts as a means of meeting the rising costs of production and the declining load factors.
- Electric companies as a group must foster the industrial development of economic nuclear power.

These interviews also indicate a few specific ways in which EEI can make constructive contributions in meeting these common challenges.

EEI will, for instance, strengthen its staff to make available more of the analysis and interpretive studies which will give meaning to its vast storehouse of industry facts and statistics. This material, in raw form, has long been available to the industry and the public, but only occasionally in a form which could be appreciated and understood by the layman.

Along the same line, EEI will continue to make available to the industry studies and material relative to the federal power issue.

In addition, the organization, through its commercial department, technical and other committees, will continue to act as a clearing house and, to a limited extent, as an advisory coordinating center to aid company efforts in numerous important areas. These areas include the development of economic nuclear power, the promotion of electrical living and adequate wiring, and the advancement of technical and managerial techniques.

In its present role, this is as far as EEI intends to go. Certainly it has made tremendous contributions in the area it has chosen to serve.

There are a number of people in the industry who think EEI should go further. This was evident in the speeches on the formal convention program and in the conversations which we had with numerous delegates at the meeting. These people think that EEI should not only supply the facts but should conscientiously undertake to answer the many attacks leveled at the industry. They want EEI to become the voice of the industry and to furnish a spokesman who can stand up and slug it out with the industry's most vocal critics.

But it is evident from the Kennedy and McAfee interviews that there is little inclination on the part of its leaders to broaden EEI's function as the fact-finding body and the information clearing house for the electric companies.

Heat Storm Hits New York, Chicago; Utilities Surprised

Consolidated Edison and Commonwealth Edison caught off balance, but both bounce back to normal quickly. Elsewhere utilities also are prepared, a special EW survey shows, as trend to summer peaks and growing air conditioning loads continues

A heat storm hit New York and Chicago June 17, catching Consolidated Edison Co of New York, Inc, and Commonwealth Edison Co off balance. Both utilities quickly bounced back to normal operation, however, and say they are prepared for heat storms this summer.

This preparedness generally characterized other utilities surveyed in the South Central region which was plagued in 1954 by a searing summer. EW's survey shows utilities are much better prepared to face another scorcher. They've strengthened facilities and are keeping tabs on their hot-weather loads.

New York . . .

Consolidated Edison fell victim to a group of minor breakdowns which combined to create a temporary crisis. At the peak of the trouble, Con Ed had 500,000 kw of capacity either broken down or in normal summer storage.

In one instance, an I. D. fan bearing broke; in another, a boiler tube blew; in a third, a part failed on a coal grinder; in a fourth a tap changer failed; and in a fifth case, a field connection "let go."

The company was able to get only 85,000 to 125,000 kw from Long Island Lighting Co and 100,000 to 200,000 kw from Niagara Mohawk Power Corp, both of which were meeting high loads themselves as heat blanketed New York State.

Some service was cut for short periods in suburbs, and some industrial and commercial customers were asked to curtail power use to a minimum. System voltage was reduced 5% to 6%. But service was normal the next day.

Chicago . . .

Commonwealth Edison had 400,000 kw out for maintenance and repair in preparation for a midsummer peak. It called on Wisconsin and neighboring Illinois companies for 120,000 kw, and reduced voltage 6%. By 3:45 P.M., voltage was normal—partly because a new 275-Mw Will County Station unit was pressed into service for 75,000 kw.

Commonwealth Ed asked its steel mill customers holding interruptible contracts for furnaces to shut down the furnaces temporarily. Load figures for the June 17 scorcher were not available as EW went to press, but company officials thought the load would approach last winter's peak of 3,734,000 kw.

Elsewhere, utilities likewise are prepared, as reflected by these on-the-spot reports from areas striken before by heat waves:

Dallas, Fort Worth . . .

Here in Texas, last year was a scorcher and this one is unseasonably mild thus far. The problem this year is to build up demand rather than to cope with heavy loads. Heavy summer air conditioning loads are an old story here and utilities have expanded their systems to deal with it.

Texas Electric Service Co which serves Fort Worth and other areas has built up its distribution facilities in areas of heavy use. "Our distribution system and generating capacity are adequate to meet any foreseeable demand," reports Beeman Fischer, assistant to the president.

Dallas Power & Light Co has a total of 960,000 kw capacity and for the past few years has been adding capacity at better than 100,000 kw per year. "We have made 13,000-v laterals available in most residential alleys," says H. M. Walne, director of public relations at DP&L, "and we are able to put 5-hp or larger air conditioners on 3-phase systems."

To keep track of local sales of air conditioners, DP&L checks with the city for permits issued to builders for central systems (these permits give the hp of the units), and for room units it checks with distributors. TESCO, on the other hand, checks with dealers.

The slump in housing during the past year has helped keep the load growth below normal, and several Texas utilities report that electricity use has been running below their estimates for 1957. This provides additional reserve capacity so that utilities are apparently well set to face any heat wave that may come.

Oklahoma City . . .

"Our gun is loaded," says John Wallis, chief planning engineer, Oklahoma Gas & Electric Co, "but

we don't have any place to shoot it." That's the way he describes the situation in his territory where mild weather has also been keeping peaks down.

But, if and when the hot weather comes, OG&E is prepared. The current prediction is for a summer peak of 693,000 kw, and OG&E can call upon 767,000 kw, of which 728,900 kw is in its own plants.

The company's continuing expansion and beefing-up program kept it out of serious trouble in 1954, when some other firms were caught with their capacity down. OG&E had no major equipment overloaded during that unusually hot summer.

Earlier this year OG&E completed a capacitor program which added 48,000 kvar to its system.

To keep tabs on commercial air conditioners, OG&E relies on changes reported to its office which affect commercial contracts. Dealers are helpful in keeping the company up to date on room unit sales.

Topeka, Kansas . . .

Kansas Power & Light Co says it is "prepared to provide electric service for air conditioning for any residential or commercial customer who desires it." Within the past three years the company has shifted from a winter to a summer peak, mute evidence of the effect of air conditioning.

KP&L President Balfour S. Jeffrey reports the company anticipates a 20% annual increase in peak load and prepares its plant for such an increase.

For the past several years, says Jeffrey, KP&L has been making customer surveys to indicate the possible purchases of air conditioning units and other electrical appliances. In addition, all customers and dealers are asked to advise the company before a unit is installed so that the company can make the necessary lead-in and transformer changes, if any are needed.

Jeffrey said sometimes the surveys do not forecast the exact locations of the installations, but that they do show the general locations. At the worst of the hot spell last summer, he said, if customers installing air conditioning units did not give sufficient advance notice it sometimes happened that crews were busy and could not make the proper line and transformer adjustment for several days after installation. This was due more to demand on personnel rather than on equipment, be said.

During the past year, KP&L spent some $11.4 million to expand electrical facilities of which $862,000 went for transmission and $4.6 million went for distribution. The 1957 budget calls for increased spending for expansion and improvement.

Kansas City, Mo. . . .

Kansas City Power & Light Co has been able to meet its peaks fairly comfortably since the terrible summer of 1954. That was the summer when Kansas City residents sweltered through 30 days of above 100 deg temperatures. Top was 112 deg on a memorable July 13.

This year the company is pretty sure it can meet the air conditioner loads that are building. In the latter part of 1954 the company began the work that changed primary distribution system from 4,000 v to 12,000 and 13,200 v. Larger transformers went in and secondary circuits were rearranged. More than $11.9 million went into this

(*Continued on page* 88)

Air Conditioning Sales Boomed in '56 Almost Nationwide

State	Room Unit Sales, 1956	Residential Customers
Alabama	30,400	670,974
Arizona	640	236,037
Arkansas	16,000	372,236
California	46,400	3,800,389
Colorado	3,200	425,978
Connecticut	14,400	676,659
Delaware	6,400	105,718
D.C.	38,400	*
Florida	72,000	1,121,868
Georgia	28,800	936,472
Idaho		174,742
Illinois	153,600	2,492,089
Indiana	33,600	1,204,578
Iowa	25,000	713,273
Kansas	27,200	581,276
Kentucky	19,200	681,148
Louisiana	49,600	749,992
Maine	1,600	292,121
Maryland	25,600	825,788*
Massachusetts	27,200	1,432,686
Michigan	38,400	2,063,460
Minnesota	17,600	878,370
Mississippi	19,200	493,727
Missouri	51,200	1,126,787
Montana		181,936
Nebraska	24,000	391,300
Nevada		64,393
New Hampshire	1,600	189,220
New Jersey	92,800	1,623,736
New Mexico		180,297
New York	211,200	4,475,804
North Carolina	25,600	†
North Dakota	1,600	160,595
Ohio	59,200	2,477,148
Oklahoma	27,200	617,099
Oregon	1,600	481,885
Pennsylvania	102,400	2,950,647
Rhode Island	4,800	245,780
South Carolina	14,400	1,575,236†
South Dakota	3,200	179,613
Tennessee	49,600	916,856
Texas	166,400	2,165,465
Utah	1,600	206,821
Vermont		108,974
Virginia	28,800	870,535
Washington	1,600	759,816
West Virginia	8,000	468,234
Wisconsin	22,400	974,401
Wyoming		86,541

Source: Air Conditioning & Refrigeration Institute, & EEI * D.C. and Md. figures combined † NC and SC figures combined

WASHINGTON WIRE

Idaho Power Takes the Stand, Refutes Illegal Writeoff Charges

Worst sort of persecution says Pres Roach of probe into ODM issuance of fast tax certificate to utility

Company officials deny charges of misrepresentation, stock market profits; claim project would return $565 million in benefits over its 50-year life

Idaho Power Co has been given its "day in court" before Sen Estes Kefauver's antitrust and monopoly subcommittee.

Company officials were there to refute implications by committee Democrats that there had been anything sinister or illegal in the manner in which they obtained fast tax amortization certificates for the Oxbow and Brownlee dams.

For weeks Kefauver has been poking through the circumstances surrounding the issuance of the certificates by Office of Defense Mobilization last April 17.

He raised the implications that the certificates were obtained by misrepresentation; that the company could not meet the specified completion date of Dec. 31, 1958; and that someone profited from advance knowledge of issuance of the certicates by dealings on the stock exchange in Idaho Power Company shares.

A $339-Million Benefit: Kefauver

He charged, on basis of testimony by Federal Power Commission Chief Accountant Russell Rainwater, that the company would benefit by $339 million over the 50 years of the license while the government would be out of pocket $83 million in the same period.

Idaho Power originally applied for its certificates in August, 1953, when the ODM goal for electric power, now closed, was still open.

Although Kefauver has been fishing for side issues, the crux of his argument is that Idaho Power misrepresented its case before FPC and in subsequent advertising in which the claim was made that the Hells Canyon project will be constructed without cost to taxpayers. In fact, says Kefauver, it will cost the taxpayers $83 million.

Idaho's Claim Still Holds: Roach

Idaho Power Pres T. E. Roach, backed up by Vice President John Kimball and Counsel R. P. Parry, vehemently insisted the claim was as true today as when first made that the project would be built entirely with company funds.

Furthermore, said Roach, the project would return in benefits and taxes over the 50-yr life of the license a total of $565 million.

Sen Everett Dirksen (R-Ill.) asked Roach if he had compounded the interest on these benefits. "It (compounding) is the great gimmick here."

Roach replied that to do this would make the figures "so fantastic . . . as to beggar description."

This reference stemmed from Rainwater's estimates of benefits to the company and loss to the government which he admitted he had done by compounding the interest.

When Idaho Power officials and committee Republicans questioned his calculations, he said the $83-million figure was based on the assumption that the government would have to borrow money at 3½% as a result of the amount of taxes foregone by the certificates.

He admitted under questioning, however, that he hadn't figured in the benefits from the project.

Sen Arthur Watkins (R-Utah) then told the committee Rainwater's method of figuring should also be applied to the benefits. For federal taxes alone, he noted, the annual figure of $5.6 million would total $282 million over 50 years and if interest is compounded on Rainwater's basis, this would total over $2 billion in 50 years.

Watkins said the benefit from the company's project "over-balance anything you lose in taxes, no matter how you figure it."

Times Are Tough: O'Mahoney

Sen Joseph O'Mahoney (D-Wyo.) told Roach that because the federal government was in bad shape financially, Idaho Power should surrender the amortization certificates.

Roach replied the very thing the company was doing would save the government millions of dollars in appropriations and generate more millions in taxes which would be paid in directly to the Treasury.

O'Mahoney's insistence that Idaho Power give up its certificates led Roach to ask why, of all the thousands of firms given certificates, Idaho Power should be singled out. "This is persecution of the worst sort," he said.

Answering Kefauver's charges that someone had profited on stock market transactions in Idaho Power shares, he said he couldn't understand why an ODM tax certificate would make anyone rush out and buy stock when the effects of the certificate would not show in the company's tax payments until 1960.

Look for Electrical World's July 1 report on "Why the Hassle Over Fast Tax Writeoff?"

Work Starts on Biggest U.S. Reactor

FIRST COLUMN'S bolt is tightened by, from left, Commonwealth Chairman Gale, Illinois Governor W. G. Stratton, and McCune. Murray and Durham watch

Ceremonies for start of major construction on Commonwealth Edison Co's Dresden nuclear power plant were observed June 12. More than 400 guests took part.

Willis Gale, Commonwealth chairman, said that in starting construction of America's largest nuclear power reactor, private industry is investing its capital, experience and productive skills to help pave the way to competitive nuclear power.

Dresden will have a generating capacity of 180,000 kw. It will be a dual-cycle, boiling-water reactor.

Atomic Energy Commissioner Thomas E. Murray said "Dresden represents a major step in the development of industrial atomic reactors. It demonstrates the willingness of private industry to contribute substantial funds and manpower to the industrial reactor effort."

Murray urged construction of two or three additional large reactors, if necessary, with government funds. He agreed with Gale that any power reactor program extension deemed necessary in the national interest should be accomplished in such a way that public power is not favored over private. "The question of the methods and rates by which industrial atomic power is developed in furtherance of the national interest transcends the issue of public versus private power," said Murray. "Dresden station, conceived by Willis Gale, is a concrete manifestation of 'responsible capitalism' at its best."

F. K. McCune vice president, General Electric Co, likened Dresden to the 5,000-kv vertical turbine installed at Commonwealth's Fisk station in 1903. That, he said, was the first large steam turbine in America.

McCune added that "General Electric has spent $11 million on the project. An additional $20 million has been committed in orders for materials and equipment."

Durham Urges More Prototypes

Carl Durham, chairman, Joint Committe on Atomic Energy, said the committee would like to see more prototype power reactors undertaken in the next few years. He expressed pleasure "that the Commonwealth Edison Co, . . . has consistently advocated that we get along with our atomic power program rather than fight the windmills of particular philosophies."

Congressman Melvin Price (Ill.) another JCAE member, said the people of Illinois can be proud of the fact that Commonwealth and its Nuclear Power Group partners are going ahead without direct financial assistance from the Federal Government.

Also in the group are: American Gas & Electric Service Corp; Bechtel Corp; Central Illinois Light Co; Illinois Power Co; Kansas City Power & Light Co; Pacific Gas & Electric Co; and Union Electric Co. This group contributed 15 of the $45 million contract price at Dresden, as a nuclear research fund.

AEC Seeks OK on Funds for '58 Power Projects

Atomic Energy Commission has proposed 1958 projects which would total $123.8 million under first, second, and third-round invitations to groups to build power reactors. It specifically wants authorization to put up research-development and reactor construction funds, and to waive fuel use charges. Only project in which reactor construction funds aren't involved is Power Reactor Development Co project involving $4.2 million R. D.

Other projects up for authorization: Consumers Public Power District, $44.2 million; Elk River Electric Co-op, $8.4 million; Wolverine Electric Co-op, $4.9 million; City of Piqua, Ohio, $7.5 million; and Chugach Electric Assn, $13.6 million. Authorization is also sought for $30 million for general research and development funds under the third round in which AEC reports it is negotiating on Florida Nuclear Power Group and Northern States Power Co proposals, and $11 million second round construction expenses.

Total program actually comes to $147 million with addition of $23.1 million for waiver of fuel-use charges not involving specific appropriations. This didn't include Yankee Atomic Electric project.

Partnership Gains Some Boosters

Teamwork trend—plus a burr or two—highlighted as company operation of city- or REA-owned generating plants picks up steam in four small town areas

Partnership can be more than a vaguely stated policy in the electrical power field. It can often work best on a local level where mutual benefits are apparent to companies, cities cooperatives, and particularly to customers. Several recent, widely separated developments provide examples.

Last month's dedication of a steam-plant unit near Lead, S. D., for instance, found presidents of Black Hills Power & Light Co and Rushmore G&T Electric Cooperative extolling benefits of partnership.

The power company is leasing the 16.5-Mw plant and selling output to the six co-op members of Rushmore. Excess capacity will be available to Black Hills for sale to its customers. A similar agreement was made by the two companies for a 10,000-kw unit in the Osage, Wyo., plant of the power company in 1952.

"This type of partnership operation, though unique, has been of mutual benefit to Rushmore and Black Hills and has proved to be successful in all respects," agreed Oliver G. Rose and Neil Simpson, G&T and company presidents, respectively.

The G&T members are Black Hills Electric Cooperative, Inc., Butte Electric Cooperative, Inc, La Creek Electric Association, Tri-County Electric Association, West Central Electric Cooperative, Inc, and West River Electric Association. Tri-County co-op, the newest member, is the only Wyoming representative. It will be the main beneficiary of the new unit.

Cost of the plant addition was $3.5 million. It was loaned by REA. The unit has been leased to Black Hills P&L for 40 yr.

Lease Set in Michigan

This setup is similar to the arrangement in Escanaba, Mich. Here the Upper Peninsula Power Co will lease a 25,000-kw plant which the city intends to build. The new steam plant's financing will be derived from municipal bonds. UPP will pay an amount equal to the annual interest and amortization of 30-yr covering the total cost.

The city will purchase power for its own distribution system from UPP for 1¢ a kwhr, plus or minus a fuel clause adjustment. The lease arrangement is for three 10-yr periods. The city retains the option to renew the contract at the end of each period.

Before the partnership deal evolved, though, a heated fray occurred. Escanaba has for years obtained power from a paper mill plant outside of town. When the mill's expansion upped electricity needs, it announced the contract with the city wouldn't be renewed. This included some distribution lines maintained by the mill's power company division.

Co-op Made the First Move

A neighboring co-op became the first aspirant to fill the power void. With the added distribution system it could have integrated its own system. And with the load of 20,000 Escanaba citizens, the co-op would have been able to build a plant to sell wholesale power to the city and its own rural customers instead of purchasing from privately owned companies.

Next, Upper Peninsula Power Co offered to buy the city's facilities and proposed a plant within the city. Subsequent to this offer, Escanabians favoring a municipal plant began mobilizing.

When the co-op and municipal-ownership proponents joined forces, this led to a vote in favor of retaining the municipal system. Another election, one which decided between an REA or a city plant, was slated to follow. The second vote was never taken. UPP submitted the wholesale power offer as it now stands and won support in a public hearing.

The city crews are now rebuilding and changing lines over to 12.5-kv. UPP is doing the same with the paper mill's system. The company also is working on a 69-kv tie line to its system 72 mi away.

Despite these differences, Escanaba citizens now are confident the city can exploit natural advantages besides adequate power to attract industry. These include industrial sites, unlimited supply of pure water and a deep-water port which will ultimately be tied to the St. Lawrence Seaway.

Work Starts in Colorado

Industrial advantages is a goal too, for four co-op members of the Colorado-Ute Electric Association. Start of construction for their $9-million, 37,500-kw plant at Nucla, Colo., is due soon. Western Colorado Power Co will operate the plant. The power company's system will be integrated with the plant and co-op lines giving a total generating capacity of 73,000 kw. Completion next year is expected to lure additional oil and uranium load.

But there's controversy brewing here. One of the Colorado-Ute's four members—Delta-Montrose Rural Powerlines—is considering a lawsuit to get out of the association. The reason stems from a long-standing controversy on the proposed plant's site. REA Administrator David Hamil is believed to have turned down a Delta-Montrose request to cancel its contract for the plant's output. If it or any of the other association members cancel out, Colorado-Ute's $10.5-million REA loan would likely be left in jeopardy.

Citizens of Spur, Tex., voted earlier this year to lease the city's plant and distribution system to West Texas Utilities Co. The more than 2-to-1 margin authorized a 40-yr lease and a 40-yr franchise. Both the company and the municipal plant have served Spur since 1928.

The partnership concept is gaining other backers. Power pool and tie-line deals have been made in the Midwest, South Dakota, Rocky Mountains, and other U. S. regions. And as power demands continue to soar, indications are that the mutual economic and service-reliability advantages of teamwork will bring study of new teamwork arrangements.

Britain-France Link Nears

"All outstanding technical problems" of the Britain-France submarine cable project have been overcome, says the Central Electricity Authority. Experiments with test lengths of cable have been successfully completed and sites selected for the terminal stations.

Terminal buildings will contain metering and regulating equipment to handle the cross-channel exchange. The cable will be capable of carrying up to 150,000 kw at 200 kv dc.

Tightening the Hurricane Belt

By 1959 weather radars will guard the Atlantic and Gulf coasts from Eastport, Maine, to Brownsville, Tex. The Weather Bureau surveillance will squelch a hurricane's most deadly factor—surprise. Gordon E. Dunn of the Miami, Fla., Weather Bureau office, told Southeastern Electric Exchange Engineering and Operating Section that radar normally should permit six hours or more warning. For rapidly accelerating New England storms, though, only two to four hours advance notice may be possible.

A network of warning stations across the Bahamas has proved accurate enough through the years to warrant bi-weekly bulletins. The hurricane-probability reports will be issued on the first and fifteenth of each month. Resort owners in Miami aren't too happy about the development, however. They say the announcements are apt to scare off tourists.

World's Biggest Unit ... Today

After 2½ yr of construction a 275-Mw generating unit has gone on Commonwealth Edison Co lines. General Electric Co, builder of the Will County Station turbine generator, says the unit exceeds in capacity anything now in operation.

The distinction will be short lived, though. Included in record-breaking electric utilities' expansion plans are still larger units up to 450 Mw. Commonwealth Ed's program calls for three additional units rated 325 Mw.

Water Table Gets 'Recharge'

Back in 1953 farm leaders in the parched Winter Garden, Tex., area decided to do something about the high costs of deep-well drilling for irrigation water. The Garman brothers built a 2,000-ft long "recharge" dam on their farm near Uvalde. After it was completed they drilled a well to a 295-ft depth. A ditch was dug from the dam to the well and a drop gate set in front of the hole.

When rains finally drenched the area this spring underground flow down the well reached 30,000 gpm. Geologists estimate the water table has risen 4 ft already and additional increases are expected. Four other dams have been completed in Uvalde County.

TVA Neighbors Wary

Tennessee Valley Authority supporters will lose support of Congressmen from adjoining states if they accept a geographical limitation on a TVA self-financing bill. Rep J. Carlton Loser (D-Tenn.) made this observation recently, adding that the self-financing bill sponsored by Sen John Sherman Cooper (R-Ky.) "is unsatisfactory to members of Congress in the Tennessee Valley" because of the limitations and a requirement that TVA pay both interest on proposed bonds and continue payments on its capital investment. A large part of Cooper's home state, incidentally, is outside TVA area.

"There are too many demands on TVA for electricity in Valley areas now being served to make any valid argument in favor of a geographical limitation," Loser said. Oak Ridge use takes 57% of TVA output "and that has greatly restricted the operation of TVA in its effort to serve the people," he added.

Utilities Spark Light Contest

Requests for rules and entry forms are flowing in for the 1957 International Lighting Competition, reports Berlon C. Cooper, chairman. More than 60 utilities have requested forms for distribution to other eligible contestants, he said.

After receipt of the entry forms, contestants are asked to complete a comprehensive folder kit questionnaire. Deadline for this is Oct. 25. The contest is sponsored by Electrical World, Electrical Merchandising, and Electrical Wholesaler, all McGraw-Hill publications. For information write Cooper, 330 W. 42 St, New York 36, N. Y.

Just 'Git' Isn't Enough

There's about a ½-in. space at the bottom of meter sheets. Here's the tale two Carolina Power & Light Co meter readers squeezed in:

January—"Watch for dog here—say 'Git Brownie.'"

February—"Brownie won't git."

March—"Yes he will."

April—"No he didn't."

May—"What happened to Brownie?"

The cryptic notations appeared at the bottom of the meter sheet in two different, hasty handwriting styles.

Safety Man Gets Help in War on Snake Bites

Oscar, an 18-in. copperhead (*Agkistrodon mokasen*), has made a big hit with Texas Electric Service crews. His languid appearances during Safety Analyst Burt Gannon's demonstrations help drive home dangers and treatment of snake bites.

Though none of the Ft. Worth firm's workers has ever been bitten on the job, Gannon decries taking chances. Texas has the dubious distinction of having more snakebite deaths than any other state.

The analyst's primary rule is "stay away from snakes in the first place." But, he warns employees, this isn't easy since snakes are fond of holing up in unlikely places and don't always give warning of their presence.

Rock and trash piles, stacked lumber, tree stumps, and debris offer protection and food sources, Gannon says. Workers should take care in placing hands and feet where snakes may be hidden from view. Rocky ledges, rodent burrows, and logs are also potential snake dens.

Gannon stresses identification of poisonous snakes in his safety lectures. He quotes the old rhyme "Red on yellow kills a fellow/Red on black, venom lack." As the deadly coral has the same coloring as a harmless variety, "If you see one," he says, "don't stand around reciting poetry. Just get out of the way—quick."

He points out differences of the coral's neurotoxic venom (painful bite, little swelling and discoloration) and the pit viper's hemotoxic (gradual discoloration and swelling where bitten). And he stresses immediate first aid. Time and again, though, people bitten by harmless snakes are treated and hospitalized because the snake was incorrectly identified. Others bitten by harmless snakes have died from nothing more than fright.

Gannon uses photographs and posters to show the distinguishing fang holes of a poisonous variety compared with the harmless type's uniformly small punctures in two or more rows sans fang holes.

Employees get the step-by-step procedure in use of snakebite kits carried on all TESCO trucks. He debunks one particularly durable bit of folklore by warning against taking whiskey. It stimulates circulation which speeds up absorption of the poison.

Heat Storms: Utilities Gird for Scorchers (*Continued from page* 82)

work in 1955, $1.5 million last year, and $1.3 million is being spent this year.

Kansas City P&L has no reliable method to ascertain the number of air conditioners that are being installed. Some dealers make reports. Others don't.

In St. Louis . . .

A Union Electric Co spokesman underscored his utility's preparedness for a scorcher. "After the awful year of 1954, we made up our minds we were not going to get in that box again," he said.

Union Electric estimated that 12% to 15% of the electricity consumed in the St. Louis area in 1954 was used for air conditioning—and that this absorbed more than half the capacity of the new $50-million Meramec plant dedicated a little earlier. At that time, Union Electric had a 1.5-million kw capacity —which will be up to 1.8 million kw when Meramec's No. 3 unit goes into service next year.

The company estimated a 168,000-kw commercial, industrial and residential air conditioning load in 1954. This included 60,000 room coolers. But the utility has stopped trying to keep tabs of local sales of residential and commercial air conditioning units. As the business got hotter with competition, dealers became reluctant to release sales figures.

But to forestall any possible repeat of heat-storm problems, the company announced in 1954 it would spend $4.5 million to beef up its distribution system. The company now estimates that about 8,500 transformers have been switched for larger units.

"We can take anything they throw at us this summer," the spokesman said.

In Detroit . . .

Detroit Edison is confident, too. It plans to increase its present capacity from 2.8 million kw to 3.0 million this year, another 320,000 kw in 1958, and another 325,000 kw in 1959 and 1960, respectively.

A spokesman said Detroit Edison is "ready, eager, and willing for anything the weatherman might dish up." The utility watches local residential and commercial air conditioning sales by "the best means possible." It depends on distributors' reports, keeping them updated and corrected by periodic appliance surveys made by meter readers.

Utilities are giving such detailed attention to heat storms, of course, because of the trend toward a summer peak, generally speaking. Any widespread and prolonged hot spell is sure to accelerate the trend. Air conditioning loads are growing: Manufacturers predict 2 million unit sales this year. They racked up nearly 1.6 million last year (see table on page 83). Furthermore, high ambient temperatures cut down the ability of utility apparatus to withstand prolonged overloads. This severely complicates the problem.

Cites Interconnected Systems' Needs to PEA

Skytop speaker says single, multiple-area systems must match input to demand and allocate input among sources

There are certain similarities in the generation control problems on both the single and multiple operating area interconnected systems, N. Cohn, Leeds & Northrup Co, told the Pennsylvania Electric Association's Systems Operation Committee at Skytop, Pa.

Both systems must match input to demand and allocate input among several sources for best performance, he said. But there is an intermediate step in the multiple operating area procedure because, by common agreement, the interconnection wants each load change to be reallocated to the area where it occurred. In this intermediate or new re-allocation, the area involved has the obligation of absorbing the load change. Getting this done is an operating criterion.

In fact, within an area, control may be intentionally designed to take the re-allocation temporarily on faster responding units (assist action) in order to get it off the ties and subsequently make a slower reallocation to those units which are to keep the change for economy.

Cohn defined "operating area" as that portion of a system within which load changes will be absorbed on a sustained basis by one or more of the sources within it.

The total correct system generation in either type of system is accomplished by governor action. The second step in the independent operating area problem and the third step in the multiple operating area problem is accomplished by shifting the governor characteristics on one or more machines, thereby forcing the changes to go where they are to repose. This shift is accomplished either manually or with supplementary controllers.

Project Is Joint One

E. C. Brown, Hartford Electric Light Co, said that four Connecticut companies, producing 90% of the power in the state, have resolved jointly to develop their bulk power facilities so that they can capitalize on the advantages of installing large units. Such capitalization would not be possible were the companies to add to their systems on an individual basis. Companies participating are Connecticut Light & Power Co, Connecticut Power Co, Hartford Electric Light Co, and United Illuminating Co.

How Companies Share

Brown said that these companies will participate in new capacity additions according to a formula based on peak power estimates. Size and location of the unit is decided by treating the combined territories as one operating area. After these decisions have been made a formal agreement is signed by all four companies. A copy of the agreement is filed with the state regulatory authorities. If additional transmission facilities are required to share the power of the new station, these become part of the agreement.

The company in whose territory the plant is built will be responsible for its design, construction, and operation. This company will also have full financial responsibility, although the cost of generation will be allocated in accordance with the peak-power participating agreement. As new units are added, participation in existing units will change.

NECA Favors Competitive Bidding

Private utility construction projects costing more than $25,000 should be submitted for competitive bidding, rather than be undertaken by utility forces. And local and national legislation enforcing such restrictions should be promoted.

A resolution to this effect was passed unanimously at the May meeting of the National Electrical Contractors' Association in Portland, Ore. Contractors representing nine Western states attended.

A "whereas" clause of the resolution referred to the private power companies' request for NECA support in opposing public power encroachment, in defense of American private enterprise. However, the resolution continues, "many of these same private power companies, protected by franchise and guaranteed return on invested capital, persistently refuse to recognize the economies that would result through taking advantages of the services of competitive electrical contractors." It goes on to ask any private power company not doing so to adopt the policy "that it shall submit to bid any proposed construction that lends itself to competitive bidding in excess of $25,000 and that it shall refrain from including in its specifications requirements for the use of 'patented articles,' such as machinery available only to the utility itself or to one contractor; and that the results of such bids be made known to all bidders."

The resolution concludes by noting that, although the district meeting will continue to support the basic principle of free enterprise, it favors legislation at local or national level to insure that private power companies operate within the "true intent of that same system and in the best interests of the public they serve."

Legislation requiring utilities to submit construction work to bid has been introduced at the last session of the Oregon legislature but was not actively pushed.

The contractors noted that they are preparing manpower needed for line construction work of private power companies by vigorous line apprentice training.

Districts 6, 8 and 9, covering the West, except Arizona and New Mexico, were represented.

Lightning Arresters Prevent

Proper application is key to arrester performance; failure probabilities weighted against those of equipment

H. R. ARMSTRONG, Staff Engineer, Overvoltage Problems, Detroit Edison Co, Detroit, Mich.

Equipment failures caused by lightning can be prevented by the proper installation of lightning arresters. This has been proved on the Detroit Edison Co system for voltages ranging from 4.8 to 120 kv. This satisfactory operating situation has resulted from following three basic rules:

1. Determination of the proper arrester voltage rating.
2. Determination of the strength of insulation to be protected.
3. Matching the protective ability of the arrester to the insulation.

Because the highest phase-to-ground voltage determines the lowest arrester rating usable for a given system, this voltage must be determined for various systems and locations. Major factors determining the maximum phase-to-ground voltage are system faults, load regulation, and overspeed of generators. Of these, regulation involving sudden loss of load and the overspeed of generators are not considered too important. The remaining factor, system faults, yields phase-to-ground voltage values dependent on the system neutral grounding.

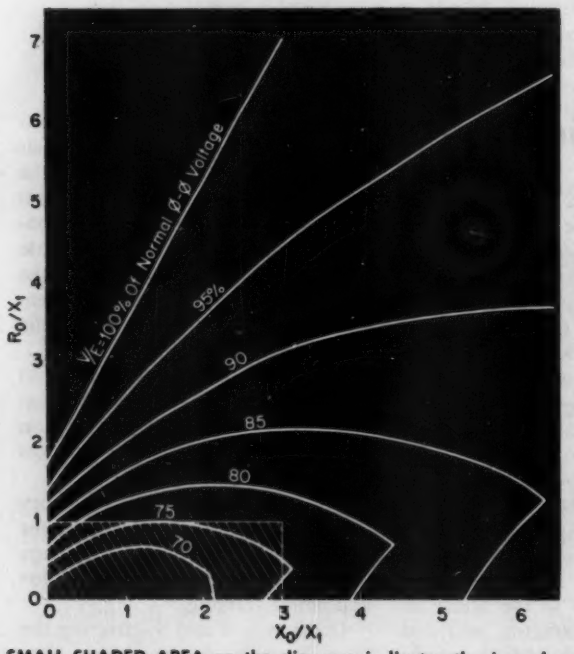
The choice of voltage rating for lightning arresters is generally between 80 and 100% of the maximum phase-to-phase voltage because it is not possible to match arrester rating exactly with expected maximum system voltage. An 80% arrester can be used on effectively grounded systems, and a 100% arrester is necessary for non-effectively grounded and ungrounded systems.

A system is considered effectively grounded when:

1. At least ⅓ of the supplying transformer kva is solidly grounded. This holds true only when there is not an appreciable percentage of the supplying kva represented by rotating machines.
2. The phase-to-ground fault current is not less than 60% of the 3-phase fault current at any location.

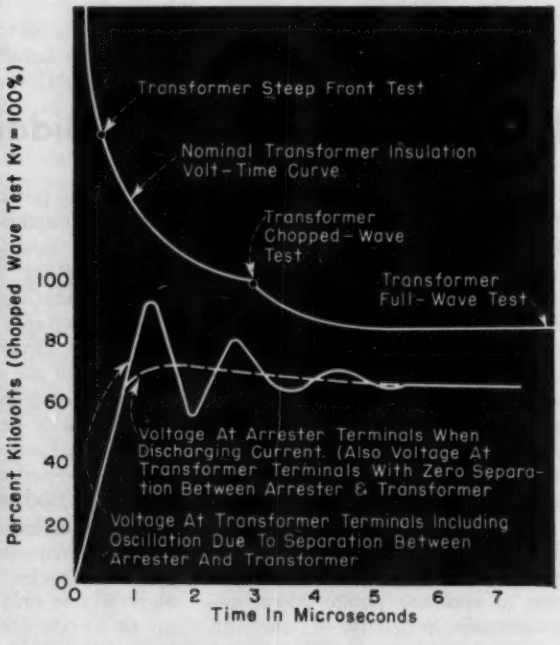
Failure to meet these conditions classifies a system as non-effectively grounded. A more precise method of determining the grounding effectiveness requires calculating the symmetrical component impedances. Ratios of these impedances plotted in Fig 1 show the maximum sound phase-to-ground voltage during faults as a percentage of phase-to-phase voltage. The shaded area indicates that for low ratios of impedances, an arrester rated at 80% of

Fig 1-Maximum Sound Phase to Ground Voltage V/E During Ground Faults on Grounded Neutral Systems



SMALL SHADED AREA on the diagram indicates the impedance ratio limits for effectively grounded neutral systems

Fig. 2 – Transformer Impulse Withstand Tests And Oscillations Due To Separation Between Arresters And Transformers



EFFECT of separation between arrester and transformer is shown by the oscillations during impulse withstand tests

normal phase-to-phase voltage is satisfactory. Multi-grounded distribution systems with several grounds per mile of line seem well grounded. But calculations indicate that their impedance ratios do not allow an arrester rating of less than 80% of line-to-line voltage.

Non-effectively grounded systems include those grounded through low resistances or reactances to limit ground fault currents. Also included are systems solidly grounded at only a few points. These allow the voltage to ground from unfaulted phases to rise considerably at outlying points on the system. For a non-effectively grounded system, the maximum power frequency voltage between unfaulted phases and ground is greater than 80% of normal phase-to-phase voltage.

Ungrounded systems are delta systems operating entirely ungrounded and a few wye systems without neutral connections to earth. For these the unfaulted phase-to-earth voltage is at least equal to normal phase-to-phase voltage and may, in special cases, rise slightly above it.

Rating Can Be Chosen

After the effectiveness of the system grounding has been examined, the arrester rating can be chosen. The selected rating should have some margin over the maximum expected voltage because it is not always possible to predict the maximum during system disturbances. When the maximum voltage is known accurately by computation, this margin can be reduced safely.

For the occasional location where protection is critical, it may be feasible to risk an occasional arrester failure rather than an equipment failure due to the use of a higher rated arrester.

After the arrester rating has been determined, the next step is to determine the impulse voltage which the protected equipment can safely withstand.

The basic impulse insulation level (BIL) of equipment manufactured since about 1940 is the crest value in kv of the full 1½ x 40 μsec voltage wave the insulation will withstand. The insulation strength of equipment manufactured before 1940 can only be estimated with due consideration of age, service usage, and maintenance practices.

Some laboratory tests have indicated that the multi-shot strength of transformer insulation may be somewhat below the original factory long-wave withstand value. How much the original insulation strength should be degraded for this multi-shot factor is largely a matter of conjecture because it is unreasonable to expect that every surge imposes maximum stress. There is also the matter of wave shape of the impulse impressed on the equipment.

Arrester Matched to Equipment

Another factor, disclosed from studies of surges entering substations, is that maximum voltage may persist for only a very short time. Accordingly, some advantage can be taken of short-time strength which is higher than full wave BIL. This short-time strength of transformer insulation is shown in the upper curves of Fig. 2. This figure shows a full-wave test level, the chopped-wave test point, and the steep-front point plotted in a curve generally used to indicate the overall volt-time characteristic of transformer insulation. Equipment in general has a curve similar in shape to that for transformers.

After the arrester rating has been determined from system voltage conditions and the insulation strength has been reviewed, the next step is to match the arrester to the equipment. Maximum voltage allowed by the arrester can be determined only after the maximum surge current that the arrester can reasonably be expected to discharge is established. Records from field measurements indicate that maximum current to be expected in a station-installed arrester is of the order of 5,000 amp. But arresters mounted on lines and at stations fed by unshielded lines may be subjected to higher currents. To be conservative, the maximum can be taken at 10,000 for station-installed arresters and 20,000 amp for those on unshielded, open-wire lines.

Because the voltage across an arrester does not increase in direct proportion to impulse current, any error in estimating expected arrester current does not have too large an influence on discharge voltage. The arrester discharge voltage for the current selected can be found in published literature for the particular type and rating of arrester selected. When there is any doubt about the interpretation of these values, it is well to consult the manufacturer.

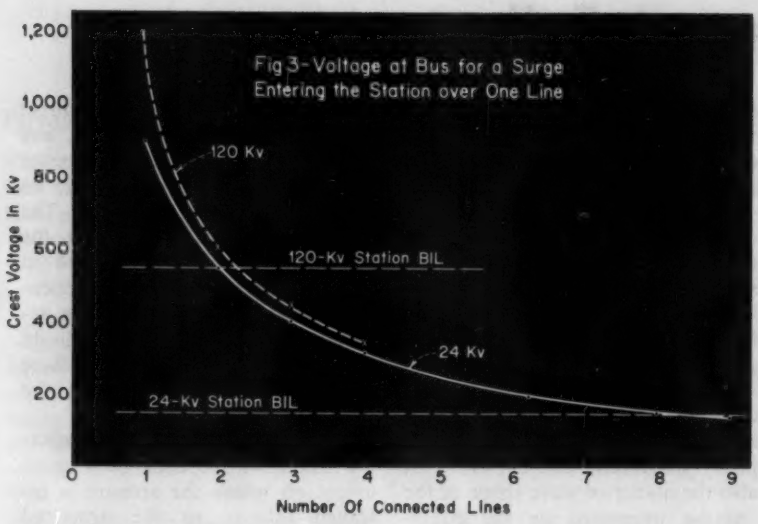
How well the arrester protects the insulation depends to a great extent on where the arrester is installed relative to the protected equipment. A typical substation layout does not provide too many places for convenient installation of arresters. The number and type of lines are fixed. The location of all major equipment within the station area is dependent usually on standardized design practices. Fortunately, locations either at a line entrance or on the bus generally are satisfactory.

For unusual cases, such as equipment with substandard insulation strength or excessive power frequency voltage, it may be necessary to make a new arrester choice. When a lower discharge voltage is necessary, a station rather than a distribution or line type can be used. When a higher rated arrester is considered necessary, it may still be possible to get good protection with one having a lower protective level.

Locate Near Equipment

When it still does not seem that the insulation will be protected, even with the lowest rated arrester with the lowest protective level, it may be necessary to locate the arresters as near as practicable to the protected equipment. An alternative would be to reduce the probability of high surge currents by shielding the station and incoming lines from direct strokes.

The shape and magnitude of the impulse voltage wave impressed upon equipment insulation when the arrester discharges are not determined by discharge current alone. This discharge voltage is modified by station configuration, the number of lines connected to the bus,



APPARENT DIFFERENCE in multi-line influence for the two voltages shown is due to ratio of line to station BIL rather than any difference in the station design

the distance between arrester and protected equipment, and other factors.

Field and laboratory studies indicate that the maximum voltage during system disturbances usually is oscillatory, that it persists only for a short time, and is dependent on the distance separating arrester and transformer. This is shown in the lower curve of Fig 2. The dotted curve is the arrester voltage that would exist if oscillation were not present; the solid curve represents the actual voltage impressed on the transformer.

The two curves in Fig 2 illustrate also the margin considered necessary between voltage allowed by the arrester and withstand strength of insulation. How much margin is necessary is controversial. But an industry consensus indicates that about 20% of the insulation strength, plus a fixed value of 30 kv, is satisfactory.

This margin is intended to cover such factors as separation distance, influence of multiple lines, and the multi-shot and short-time strength of insulation. Use of such a margin is sound and conservative when a definite evaluation cannot be made of these factors.

When separation distance and other factors have been considered as part of the problem, a margin of 20% may seem unduly conservative. Experience indicates that the probabilities of high magnitude arrester currents, in combination with other factors that produce maximum voltage, are rather negligible. When all factors are carefully evaluated and the voltage at the protective equipment has been estimated by complete analysis, a 10% margin seems adequate.

Another factor of considerable influence on the protection of station equipment is the number of lines connected to the bus. How much multiple lines reduce the voltage or whether, in the extreme case, they eliminate completely the need for lightning arresters, depends somewhat on bus dimensions and system voltage.

Curves in Fig 3 show the influence of more than one line connected to a bus for 24 and 120 kv. The great apparent difference in multi-line influence for the two voltages is due to the ratio of line to station BIL rather than to differences in station design. The wood pole 24-kv lines, with about 750-BIL kv, are connected to 150-kv BIL station equipment. For this 5:1 ratio a large number of lines are necessary to reduce an incoming lightning wave.

On the other hand, the 120-kv steel tower lines also have a BIL of about 750 kv. But the 550-kv BIL station transformers give a 1.3:1 ratio, and three lines reduce the surge to a safe value.

Short Cable Has Little Effect

Similar data are not available for cases where part of the line connected is cables. But analysis indicates that the cables would be quite effective in reducing the magnitude while sloping the front of the wave. The length of the cables is important. Short entrance cables between the station bus and overhead lines have very little effect on long waves. Long cables, however, achieve both an initial and a long-time reduction of the incoming surge voltage.

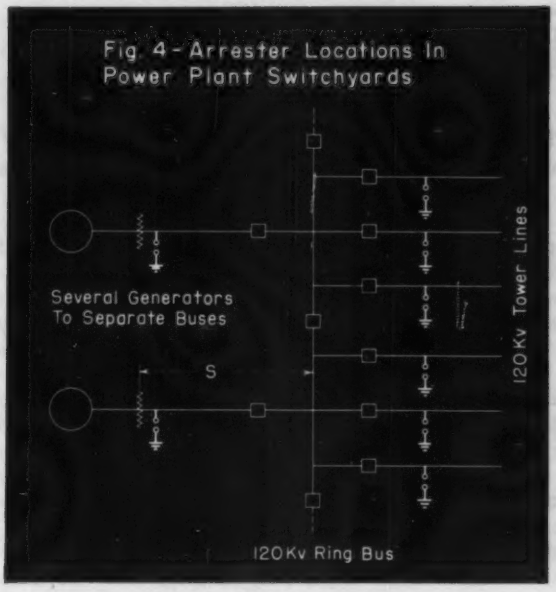
Consequences of an occasional arrester failure, when the arrester rating has been shaded to obtain better protection, depend upon whether the arrester is in a high-capacity switching or step-down station or in a smaller outlying station supplying distribution load. The probability of equipment failure also can be evaluated.

When coordination of arrester protection to equipment is difficult, there is a choice between reducing the arrester rating and risking arrester failure, or using a properly rated arrester and risking

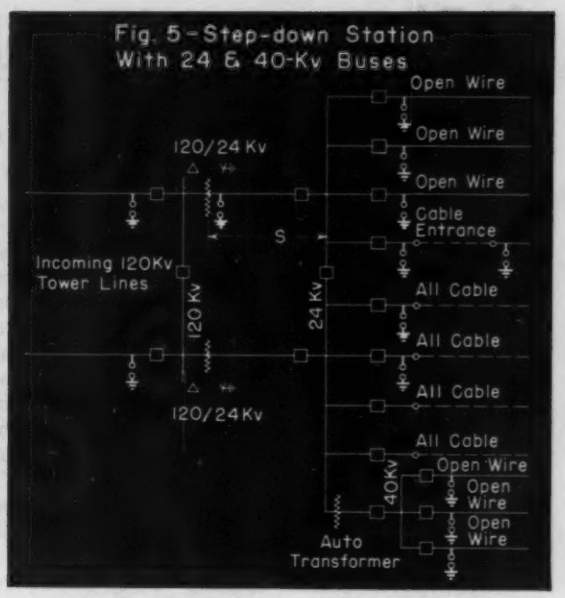
Table I—Arresters Used on the Detroit Edison Co System

Nominal System Voltage-Kv	System Grounding	Transformer BIL-Kv	Arrester Type	Arrester Rating Kv	Separation Distance[1]-Ft
4.8[2]	Ungrounded	75	Distribution	6	10
4.8[3]	Ungrounded	75	Distribution	6	10– 25
24[4]	Effective	150	Line	20	10– 75
40[4]	Effective	150 & 200	Line	30	10– 75
120[5]	Effective	550	Station	97	15–150

[1] Radial feed requires minimum separation. Multiple lines to feeding bus allow maximum separation.
[2] Pole-mounted distribution transformers.
[3] Distribution power transformers, load side.
[4] Distribution power transformer, supply side.
[5] High-voltage side of transformers.



ARRESTERS at plant switchyards are installed on line entrances and at main transformers when "S" exceeds 150 ft



AT LEAST TWO arresters are installed at 24/40-kv bus with another on LV side of transformer if "S" exceeds 75 ft

equipment failure. It may be well to examine operating practices to determine whether certain switching sequences have an appreciable influence on power frequency voltage at the arrester location during system faults.

Utility system operators often develop a philosophy governing the lightning arrester installations. It may be considered feasible to install arresters at the line entrances of each incoming line to a substation, or only on the bus. Placing several arresters in a multi-line station close to but not on the bus protects the whole station regardless of bus configuration and separation distances.

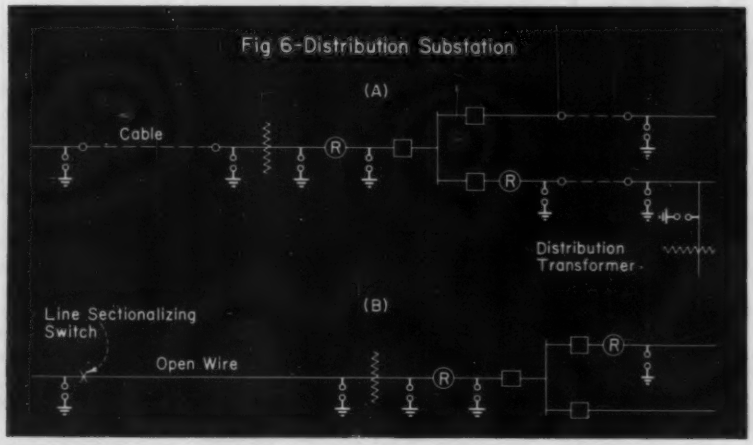
But with bus arresters, line entrances may be left unprotected with acceptance of the risk of outages when line circuit breakers are open but energized from line to another source during storm periods.

When dry-type transformers, rotating machines, and other special situations are considered, the usual rules for arrester application remain valid but much more critical. For these cases, where the insulation strength is much lower than that for oil-insulated equipment of the same voltage class, individual analysis is necessary. Additional protective measures may include special arresters and protective capacitors. When the equipment is connected to open-wire feeders, it may be necessary even to shield the feeders to eliminate the possibility of nearby direct strokes. Protection of dry-type transformers and rotating machines from traveling waves takes careful study.

Arrester ratings on the Detroit Edison system are given in Table I. The table shows the effectiveness of system groundings and the equipment BILs. From this overall picture, arrester applications for different voltage systems can be examined in detail.

For the main generators, plant switchyards, and the 120-kv transmission system, arresters are used as in Fig 4. Arresters are not considered necessary at the generator terminals. They are installed at all line entrances and generator transformers because of the large separation distance between transformers and line entrance arresters. Generator transformer arresters are more effective in reducing impulse voltage at the generator terminals than generator arresters.

(*Continued on page* 220)



ARRESTERS are installed between transformer and bus regulator in distribution substations only when both supply and feeders are open wire on the same pole

A-Plant Needs Reliable Power

GENERATION
Design

Auxiliaries, especially coolant pumping system, must be designed to prevent certain types of plant interruptions

A. R. JONES, Application Engineering, Commercial Atomic Power Activity

C. J. BALDWIN, Electric Utility Engineering, Westinghouse Electric Corp, East Pittsburgh, Pa.

The application of nuclear energy as a heat source in a power station influences auxiliary power requirements because:

1. Lack of operating experience suggests a very conservative design.

2. Certain peculiar operating characteristics of nuclear reactors dictate special auxiliary power supplies.

3. Pumping power requirements are increased.

These requirements can best be examined as they pertain to a specific reactor type, the pressurized water reactor.

This type of nuclear power plant utilizes a heat producing core containing the fissionable uranium, all enclosed in a pressure vessel. Ordinary water is pumped through channels in this core and out to a steam generator where water in a second separate system is evaporated to produce the steam which drives the turbine. The reactor cooling water is maintained at high pressure to prevent boiling in the reactor.

A steam volume in the pressurizer also serves as the surge volume for the system. A level control scheme —regulating valves and/or pumps in the makeup and drain system— keeps the required water level.

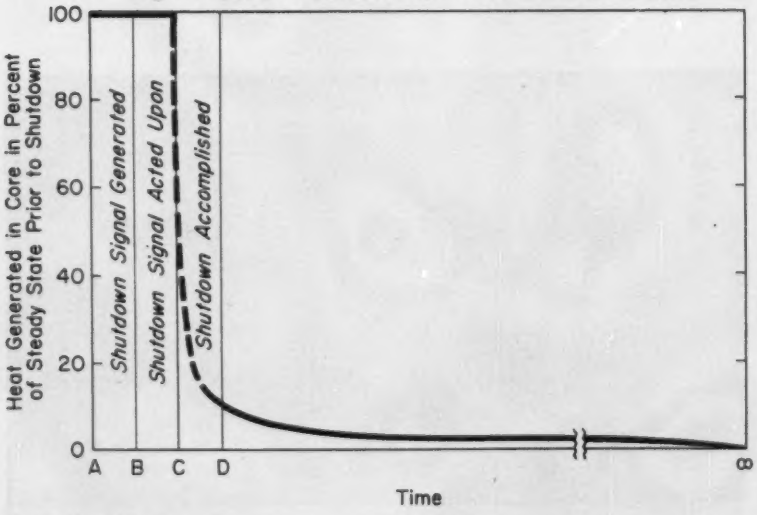
The power output of the reactor is controlled under normal operating conditions by an electric or electronic control scheme which compares the average reactor coolant temperature with an established reference signal. The output of this control scheme operates an electric power supply and ultimately the mechanisms which move the power regulating control rods in the core.

A nuclear reactor is at least theoretically capable of generating excess heat energy to a degree dangerous to the plant at a very rapid rate under certain emergency conditions, such as loss of coolant flow, loss of system pressure, or failure of control system components. An automatic shutdown system, familiarly referred to as the scram system, is therefore applied to back up the normal control. Upon receipt of information indicating an unsafe condition, this system operates to release the control rods so that they fall rapidly into the shutdown position.

Even though the control rods are completely inserted into the core and the fission reaction has stopped, the core continues to generate heat in the order of 1 to 10% of the previous operating level. This heat is energy resulting from fissions occurring during the intentional power output period but retained in the minute but complex fission fragments for a period. A shutdown cooling system of high reliability must be incorporated in the design to dissipate this delayed heat.

Adapted from a paper presented at the Winter General Meeting of the American Institute of Electrical Engineers, New York, N. Y., Jan. 21-25.

Fig 1-Reactor Produces Heat Even After Shutdown



HIGHLY RELIABLE auxiliary power system is required in nuclear power plant to insure safe removal of heat generated in reactor itself after plant shutdown

Delayed Heat Causes Problem

Safe removal of heat generated in the reactor just before and following shutdown is one of the biggest problems for the plant designed. The generation of heat as a function of time is shown in Fig. 1. The time periods B to C and C to D vary from case to case depending on the reason for shutdown. B to C may be 1 sec or less for an automatic shutdown (scram), or much longer for the normal load dropping operation. C to D may be a few milliseconds for scram or a few minutes for changes in system demand. After time D neither the operator nor the automatic control system can further reduce the heat output below the indicated curve. This energy was predestined for release when, during A to C, atoms were actually fissioning in the core.

Because there is no way to avoid the release of heat after D, the system must be designed to carry it away safely under all conceivable emergency conditions. For this reason the shutdown cooling system

Four Ways to Provide Reliable Coolant Pumping Power

Fig 2—Use of Separate Generator on Main Generator Shaft

ADVANTAGES—High inertia at low cost. Complete freedom from normal supply. No restriction on main exciter.

DISADVANTAGES—Mechanical balance and alignment problems. Design speed restricted. Extra starting connection and switchgear required. Interlocks required.

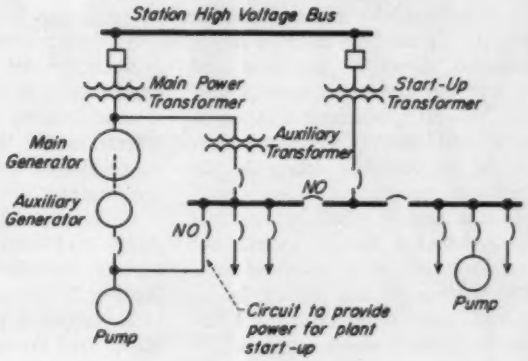


Fig 3—Use of AC to AC Motor-Generator Set with Added Mechanical Inertia

ADVANTAGES—Simplified relay and interlock needs. Design speed unrestricted. No restriction on main generator operation.

DISADVANTAGES—Pump frequency reduced if the motor is induction. Energy losses in m-g set.

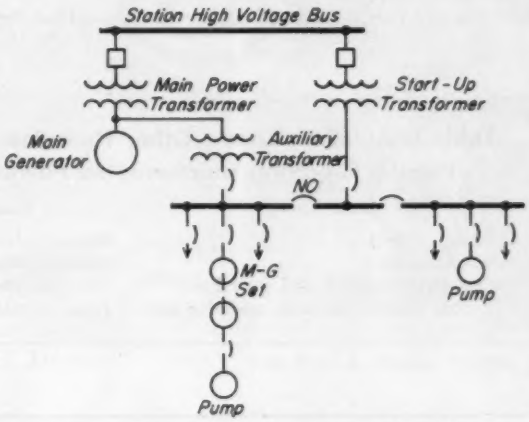


Fig 4—Use of High Inertia Synchronous Condenser

ADVANTAGES—Single machine required.

DISADVANTAGES—Most faults are not isolable. Interlocks required. System subject to stability disturbances.

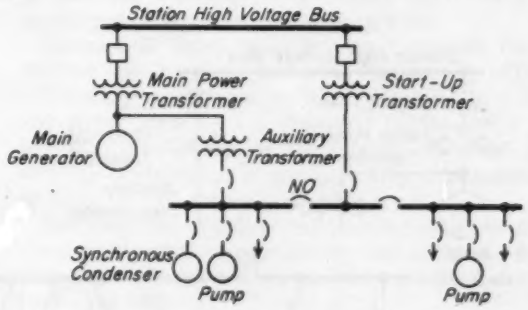
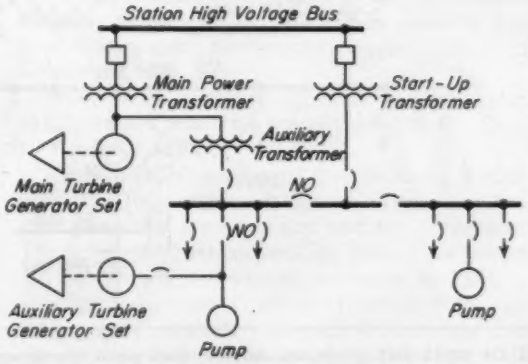


Fig 5—Use of Auxiliary Turbine-Generator Set

ADVANTAGES—High inertia at low cost. Complete freedom from normal supply. No restriction on main exciter.

DISADVANTAGES—Steam cycle complication. Extra synchronizing equipment. Energy losses in small turbine-generator set are significant. Capital cost is considerable.



pump is regarded as a vital load.

The transient condition which results when the auxiliary power system feeding the reactor coolant pumps fails is also of considerable interest. In such an event a scram shutdown signal is generated and fed into the automatic control system. Yet, an appreciable amount of energy obviously is generated during the unavoidable delays in the shutdown process.

In the interest of minimizing fuel costs, the core design should not be so conservative as to allow complete storage of this energy in increased core temperature. Likewise the canned-motor pump, which is finding wide application in atomic plants, is not easily designed to incorporate sufficient inertia to maintain coolant flow during the shutdown period. For instance, the H constant of a typical canned-motor pump is only 0.05.

The best solution appears to lie in some scheme which adds the desired inertia in the auxiliary supply system. Among schemes under consideration are the following, all of which assume multiple reactor coolant pumps:

1. Supply a portion of the total pump load from a separate generator on the main generator shaft. See Fig 2.

2. Supply a portion of the total pump load through ac to ac motor-generator sets with mechanical inertia added. See Fig 3.

3. Add a synchronous condenser of high inertia on the bus supplying a portion of the total pump load. See Fig 4.

4. Supply a portion of the total pump load from an auxiliary turbine-generator set. See Fig 5.

Any of these schemes may be duplicated for each portion of the pump power. This degree of backup, however, is open to question on the basis, first, of technical necessity and, second, of economic feasibility.

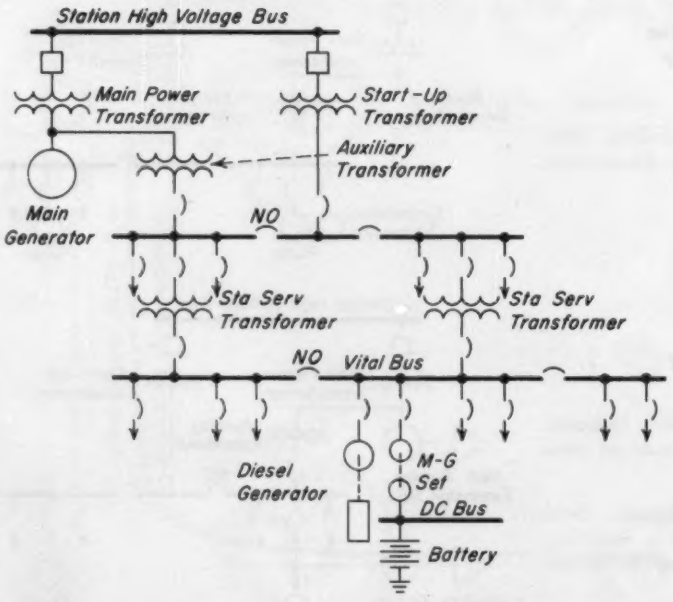
There is no way whereby one of the four schemes can be selected as the proper general solution. Of these four solutions, those in Figs 2 and 3 appear to be preferable for most installations.

Some other auxiliary loads which, at least at the present state of the art, require extraordinary continuity of service are listed in Table I. The first item, shutdown cooling, was discussed earlier and designated as a vital load. The three remaining items deserve some further comment.

Table I—Auxiliary Loads, Other Than Reactor Coolant Pumps, Requiring Uninterrupted Power Supply

Load	Reason
Shutdown cooling	Removal of heat after shutdown
Automatic scram	Need to ride through transients
Normal instrumentation and control	Need to ride through transients
Pressurizer heaters (normally operating only)	Need to ride through transients

Fig 6—Use of Vital Bus Arrangement Avoids Unnecessary Shutdowns



USE OF VITAL BUS minimizes unintentional plant shutdowns caused by voltage transients resulting from phenomenon either at or external to reactor plant

Outages Avoided

In the final analysis, the plant must be self protecting under the worst condition which is loss of all auxiliary power. To meet this criterion, the automatic scram system is made fail safe by designing it to hold the control rods out of the core against gravity. To minimize the time interval B to D (Fig 1) this system is designed for fast operation. Because of this desire for fast operation, the plant would unfortunately be shut down unintentionally by voltage transients resulting from:

1. Auxiliary or power bus switching operations.

2. Line outage cleared by recloser operation.

3. Faults successfully isolated by breaker operation.

4. Minor maintenance periods to care for difficulties in the electrical system.

From a purely safety point of view, shutdown under these conditions would not endanger the plant. However, the result would be a delay in the return to power of up to an hour while the cause of shutdown was determined and the reactor control rods were slowly raised to bring the reactor "critical"

(*Continued on page* 222)

25th ANNUAL CONVENTION

EEI Sees "Power-full" Future

Pres Donald S. Kennedy

Vice Pres J. Wesley McAfee

The issue of government encroachment in the power business dominated the speeches at the 25th annual convention of the Edison Electric Institute in Chicago June 3-5. Eight of the 15 speakers on the formal program dealt with various phases of this issue. Subjects covered by other speakers included: Utility regulation, utility financing, atomic power, recruiting technically trained men, and safety.

Both President Donald S. Kennedy and Vice President J. Wesley McAfee stressed the need for answering attacks on the industry. But during the course of their exclusive interviews with Electrical World, they covered a wide range of other subjects dealing with industry and EEI problems **(pp 98, 99).**

Hardest-hitting speech was delivered by Harllee Branch Jr., who blasted the Federal Power Commission decision on utility advertising and told of the financing practices of certain rural co-ops **(p 101).**

EEI Managing Director Edwin Vennard urged use of educational courses and frequent opinion measurement to help get the free enterprise story across **(p 102).**

Need for telling the industry story and getting across the facts of free enterprise were stressed by Kinsey M. Robinson **(p 103).**

But both public opinion studies and experts in the advertising field dictate that the industry story be told in terms of the customer's interest. Claude Robinson discussed findings of public opinion polls **(p 106)** and Thomas D'Arcy Brophy told how advertising may be used to sell ideas **(p 104)**

Leonard E. Read urged industry leaders to find effective ways to tell the free enterprise story **(p 107).**

Scholarly dissertation on the operation of federal power agencies was presented by Dean S. C. Hollister, who served on the Hoover Commission studying organization of the Executive Department **(p 105).**

Responsibility of federal and state regulatory commissions to customers, companies, and investors was discussed by Arthur Kline **(p 106)** and H. Lester Hooker **(p 108).**

Electric utilities will be able to obtain favorable financing as long as they are able to continue their good management performance, reported Albert H. Gordon **(p 109).**

Proposal for recruiting engineers and other technically trained personnel was advanced by Dr. Curtis L. Wilson **(p 110).**

Kenneth D. Nichols urged that nuclear power development be carried on through cooperative program involving both industry and the government. There should be no back-sliding toward the government monopoly that existed previously **(p 111).**

Safety is a personal matter—a human thing—and the success of any safety program is dependent upon the attitude and motivation of management. This was the thesis of Allen S. King **(p 112).**

Kennedy Offers Firm Program

DONALD S. KENNEDY,
Pres, EEI and Oklahoma Gas & Electric Co

The Oklahoman, first utility executive in recent years to get a second term in top EEI post, outlines some of his goals in exclusive Electrical World interview. He's more confident, more experienced than a year ago

There is one major difference between the Donald S. Kennedy who began his second term as president of Edison Electric Institute earlier this month and the Kennedy who began his first term a year earlier:

This time he has a better understanding of the needs of the organization and a firmer determination to help fulfill some of those needs.

Discusses EEI Goals for Year Ahead

In an exclusive interview with Electrical World the day after his re-election, Kennedy outlined some of his aspirations for EEI for the year ahead. With the support of the board of directors, he hopes the organization will be prepared to:

- Make available the necessary facts and studies on the issue of government power so as to keep the record straight.
- Share more broadly its storehouse of industry facts and statistics by analyzing and interpreting the figures in terms that can be readily understood.
- Offer its resources, through committees and the staff, in any way it reasonably can to help reverse the declining system load factors that loom for many electric companies.
- Encourage its staff members to continue their good work and sharpen their efforts to anticipate and fulfill the many demands made upon them.

Kennedy is strongly convinced that the public is entitled to know the facts about the power business and to have full information especially about the government power issue. As did other speakers on the formal EEI convention program, Kennedy asserted that a substantial majority of the American people don't want the government in the power business. Yet, he said, federal power continues to expand. "It continues because government power is subsidized with the general taxpower footing the bill. If we are to stay in business and continue to sell our product, these facts should be told," Kennedy said. He noted that many of his speeches during the previous year had dealt with this issue, and were attempts to set the record straight.

Amortization Charge Is "Phooey"

Pointing to specifics, he recalled the recent charge that the industry may reap an eventual $4.7 billion from rapid tax amortization certificates. "This," he said, "is just a lot of phooey. Actually, the basic assumptions are wrong. If the people who made the charge had bothered to make the necessary tax deductions from their own figures, their grand total would have been around $1 billion—rather than $4.7 billion. Their entire calculations are based on such erroneous premises that it is perfectly apparent they've never had any practical business experience."

In a closely related field, Kennedy said he is fully supporting Managing Director Edwin Vennard's effort to interpret EEI statistics and factual information. He said Vennard is authorized to strengthen the organization staff to accomplish this job. It will require thorough analysis of available statistics and an interpretation of what the statistics mean to the layman.

"I think there is much to be done along these lines," Kennedy said, "and I think you will be seeing some results before too long."

As he had frequently during his first term, Kennedy voiced his concern about the declining system load factor in many companies. He voiced his own confidence in the effectiveness of selective selling and stepped up sales promotion programs as means of halting the downward trend. He said he is certain that the EEI commercial department is well aware of the situation and is bending its efforts to help.

Does Not Favor Single Promotion Program

But Kennedy does not necessarily favor a single industry promotion program. Rather, he believes that all programs, national and local, are making a contribution to sales efforts. "Any program that stresses electric living helps all of us," he said.

The EEI president praised the work of the various technical and non-technical committees of the organization and the staff members who work with these committees. "I wouldn't want to single out one committee, but let's take the accident Prevention Committee as an example. Safety men from my own company have gotten much from their committee work and we have been able to improve greatly our safety performance. Our dollar benefit from this committee alone is greater than all the dues we pay to EEI."

Vice President McAfee Views Industry Problems

In exclusive EW interview, says electric companies must strive to gain public understanding of utility business, stresses nuclear power development

Question: Mr. McAfee, do you expect to be sharing more of the duties of the Edison Electric Institute during the year ahead?

McAfee: I certainly hope to be of more assistance to Don (Donald S. Kennedy, EEI President) because I know he has carried a pretty heavy burden of office during the past 12 months.

Question: Wes, what are some of the things you would like to see EEI do?

McAfee: Well, I think we might improve some of our efforts in several directions. We have to keep at the task of nuclear power research. And we must constantly improve our effectiveness in getting the public to understand our business.

Q: Along that line, what do you think of the proposed EEI committee on public relations? Would it help coordinate the various industry programs?

McAfee: Yes, I think an EEI public relations committee is worthy of serious consideration. Of course I believe that individual companies will continue to play the major role in gaining a public understanding. It is reasonable and sensible to rely mainly on the companies to form public opinion, but the national organizations, such as PIP and ECAP, along with EEI, can supply a part of background needed to do this.

Q: What are some of the major problems that the industry will have to meet in this year ahead?

McAfee: One of our troubles is that it is hard for us to realize the constant competition that is all around us. Just like other business men, we are—or should be—fighting for a larger share of the consumer's dollar. We're up against new cars, more expensive vacations, all kind of trinkets. Yet because growth has been pretty constant and business relatively "good", we have a tendency to be complacent. We know we can give good value for every cent received. It is our duty as executives to keep our men on their toes in the sales field and go after business—rather than let it trickle down to us. Pardon me for going off on this sermon. . . .

Q: The question was what are the major problems?

McAfee: In my view, they are these: We must attempt to gain a more favorable public understanding of our business. Second, we must effectively and reasonably carry out our responsibilities in the development of nuclear power. I mean aggressively pursue this development. And third, we must face up to the upward trend of fuel, capital, and equipment costs. Sure the industry has been able to make enough technical and managerial progress to offset many of the rising costs, but we can't hope to keep ahead of these forever.

"Constant competition . . .

is all around us"

"We fight for large . . .

share of consumer's dollar

Q: Recently the Federal Power Commission ruled that certain advertising expenses of electric companies were not allowable as a cost of doing business. What do you think of that opinion?

McAfee: I just think it is unsound. Because of that it won't prevail.

Q: Hasn't there been several judicial opinions which held that the determination of advertising expenditures is a management prerogative?

McAfee: I think you'll find that is true.

Q: Why do you believe FPC might have erred in its opinion?

McAfee: It's my belief that advertising—even good institutional advertising on the private-vs-public power issue—can and does promote more business and ultimately benefits the customer. After all the customer is interested in dependable service and reasonable rates. We should be free to ward off attacks that would interfere with the healthy growth of our business or raise the costs of financing expansion. Let me emphasize the fact that we must be in a position to inform our investors regarding our ability to protect ourselves and therefore our investors against the threat of government competition. We can't hope to retain our stamina, the morale of our employees, and the confidence of our investors if we must retreat from every blast leveled against us.

Q: But do you think that utilities must continue to advertise even though the cost is not allowed as a business expense?

McAfee: Sure. We must carry on this battle whether the expense is allowed above the line or not.

Q: Let's tackle another one of the subjects that's getting a lot of public attention these days. Do you think that all the utilities that have received rapid tax amortization certificates will make use of them?

McAfee: There is a real question as to whether to use rapid amortization—and that goes even for the utilities that have applied for and received certificates.

Q: But these certificates would make money available that would ordinarily go directly for taxes?

McAfee: There is a great deal of confusion in the public mind on this matter. What the certificates do is to defer taxes for as much as five years. We will have to pay these taxes eventually. And the purpose of the law was to encourage utilities to build facilities relating to the national interest at a faster pace than they would be built to meet the needs of the individual utility.

Q: On a much broader subject—do you think some of the federal power spending might be cut from the national budget?

McAfee: There's no doubt about it. We could have made significant savings over the years if feasible hydro power projects had been built by private industry. We are sure now that private industry is willing and able to build those projects that are economically feasible as power projects.

Q: From your speeches it is evident that you don't favor a "crash" program to develop economic nuclear power.

McAfee: No, not a "crash" program, but an aggressive and balanced program. Electric company management must carefully weigh the eventual benefits against the present and future costs and work out a program that will protect the interests of its customers and its stockholders. At Union Electric, we've been devoting a good deal of time and effort to nuclear power study and development since around 1950. We think these efforts are fully justified and will bring benefits to our customers.

Q: Over in the sales field, now. Doesn't Union Electric have prior rights on the "Live Better . . . Electrically" slogan?

McAfee: We may have. We were using it a long time before the present national program was conceived of. We like the slogan.

Q: Are you really pushing all-electric living?

McAfee: We've been working hard for a long time on adapting the heat pump to our area. But before we push too hard we want to be sure that it will result in satisfied customers. But back more to the point, I think the all-electric home is one of our answers to our rising cost of production. We're going to have to promote and sell hard if we are to absorb a part of these rising costs.

Q: More promotion means more advertising?

McAfee: Yes, and I think we might well spend more on advertising. At Union Electric we are using more spectaculars both in newspapers and on television. We think we reach more people per dollar of advertising in this way and that it is more effective than smaller, more frequently run ads.

Q: From time to time the manufacturers cry to us that utilities should even out their buying rather than bunch it up. Do you think the utilities can do anything on that?

McAfee: I think the manufacturers are entitled to more regularized buying. I think this problem may eventually be worked out.

Blasts Advertising Decision

HARLLEE BRANCH JR
Pres, The Southern Co

"There are those who would like to see us completely gagged and silenced in order that their efforts to governmentalize the electric industry will no longer be challenged. This brings me to the subject of tyranny—for any such effort is tyranny regardless of where it occurs . . . "

You are familiar with the efforts of Sen Estes Kefauver (D, Tenn) and Congressman Earl Chudoff (D, Pa.) and a few other government power proponents to have certain advertising expenses of our industry relating to the public and private power issue disallowed as a cost of doing business, not only for rate purposes but for tax determinations as well.

Sen Kefauver said in the Senate on April 11: "There is little doubt in my mind that these companies have been charging the public, through income tax deductions, for their own brainwashing. For the Treasury now to retrieve this money would not only be just and fair but a great help to the small taxpayers who have been bearing the burden of the cost of government."

Senator Ignores TVA Tax Subsidy

The Senator loftily ignores the fact that the small taxpayers for whom he feels such concern have been bearing the cost of tax-subsidized power in his home state of Tennessee for nearly a quarter of a century . . .

Last week, Congressman Chudoff joined in the attack, bolstered by an ex parte ruling of the Federal Power Commission which was based solely on a mail inquiry and without any pretense whatever of a public hearing.

The theory upon which this move to gag and intimidate our industry is predicated is that expenses incurred in publicizing the true facts regarding government and investor-owned power is not a business but a political expense. This overlooks the fact that our companies are service organizations and that, if we are to survive and effectively build and maintain our markets, we must convince the public of the efficiency and economy not alone of electricity but of electric service by business-managed organizations as compared with our government-financed and government-operated competitors.

For they are our competitors, not only for existing and future electric markets, but for the support and acceptance of the American people as well. We cannot let their false claims of greater customer devotion and cheaper power go unchallenged or we will be destroyed. If we cannot tell the truth about public power and its hidden subsidies, we cannot do any real promotional or public relations advertising at all.

In a way, this effort to "gag" us is heartening—for it is a confession on the part of the government power exponents that they cannot peddle their anti-utility poison to an informed and alert citizenry. This confirms what every opinion poll has shown, namely, that the growth of government power has been due to misunderstanding, ignorance, and politically-fostered confusion and that, wherever the people have been correctly informed, they have rejected this first long step toward socialization of the American economy.

Tells of "Special Financial Gimmick"

Within the past few months, the Public Service Commission of Indiana has uncovered a special financial gimmick by which some governmentally subsidized power groups maintain their pretense of "cheap public power" and enrich their members at the taxpayers' expense. Reviewing the annual reports filed with it by the rural electric cooperatives of that state, the Indiana PSC discovered that through tax exemptions and by borrowing from the federal government at an artificially low interest rate of 2%, some of these organizations have accumulated large surpluses which they are using, not to pay off their government loans, but to purchase government bonds at interest rates considerably higher than the same cooperatives pay to the federal government as borrowers. And the profit thus realized is completely free from federal income taxation.

This is certainly one of the most ingenious financial operations of our time, but one that the American taxpayers will hardly condone. Is it any wonder that the subsidized power groups and their champions scream to high heaven whenever the suggestion is made—as it has been made by President Eisenhower and some Congressional leaders—that the federal government cease lending money to these organizations at less than the government's own cost of money.

It is difficult to understand why these same groups seek to divert attention from their own favored status by attacking investor-owned utilities which were granted a mere postponement of income taxes on a relatively small portion of their facilities.

The People Must Be Informed

EDWIN VENNARD,
Vice Pres, Managing Director,
Edison Electric Institute

"If our employees have the facts about these (government power) issues and our economy and about American freedom, we have reason to believe that they will want to keep that system and they will want to do the things necessary to keep it."

Government encroachment in the power field is ironic in the face of the fact that there never has been a genuinely popular demand for federal power.

The indifference of the American People to the government's operation of businesses in competition to private enterprise may be attributed to a lack of information on the true facts. Public opinion surveys and studies have established an unshakable correlation between information or the lack of it and basic philosophical beliefs: The more people know about our economic system the more they tend to favor the free enterprise system.

Facts Change Opinions

The electric companies discovered that much of the indifference toward the electric industry could be attributed to a lack of knowledge of the facts. Although average price of household electricity is only about 34% of what it was in 1916, while the cost of living has increased 2½ times, the general public was not aware of this trend.

Advertising programs were designed to let the people know about the power business and its price record. Measurement of knowledge and attitude was made before and after the programs. Every survey indicated that when the people had the facts, their opinions changed about government operation of the power business.

But why does government encroachment continue despite the industry's excellent record in areas of engineering, finance, sales, economics, price, and service and when the majority of the people do not want it? Perhaps it is safe to say they are unaware that the government gives tax money without interest to federal power projects—purely commercial operations; lends money to further these commercial power operations at an interest rate below the market price; gives tax discrimination and preference in the sale of government power.

Government subsidies enable government power projects to sell power below cost at the expense of the nation's taxpayers. If two of TVA's subsidies—cost of money and taxes—were removed, TVA's rates would have to be nearly doubled in order for it to break even —except the rate charged to the Atomic Energy Commission. This rate is already about the same as rates charged AEC by power companies. Thus the taxpayers, who own AEC, subsidize TVA but get none of the subsidy back in the electricity they buy from TVA. All other users of TVA power are getting it at about half price—at the expense of the nation's taxpayers.

As a first step we should give our employees information on both the economics of the power business and the issue of business-managed vs politically managed power. Both are essential to a good basic understanding of the problem.

Measurement Is Essential

At periodic intervals we should measure the knowledge of our employees on the basic facts about our system and about the power issue. We should strive to reach a goal of 80% in realization of the facts. If our employees have the facts about these issues and about our economy and about American freedom, we have reason to believe they will want to keep that system and that they will want to do the things necessary to keep it.

We should also measure the knowledge of three other groups—stockholders, opinion leaders, and the general public. We should make every effort to bring their understanding to a satisfactory level.

Sometimes our rates are compared with subsidized government power rates with the implication that our price is "high" or that we are not operating as efficiently as men in government. People should know that so-called "public power" is not cheap power; it is just that large portions of cost are absorbed by government subsidy. Considering the nation's electric customers as a group, they pay no less for government power than for power generated by America's tax-paying power companies. It is only a bookkeeping shuffle that makes it appear so.

An understanding of this fact is a basic part of creating the climate of understanding which will enable our companies to sell power as we have in the past. Let us not toss this effort off as some kind of frill which we do not need; it is and will remain an integral part of the sales process.

Given the Facts, People Are Fair

KINSEY M. ROBINSON,
Ch. and Pres, Washington Water Power Co

"Are the people getting the facts? I must say private industry is not doing so well in this respect. Three socialistic rules are working against us . . . I would like to recommend three steps which should improve customer understanding."

How is the public affected by information adverse to public utilities? Do customers nod agreement? And what are utilities doing to counteract such information?

Public opinion no longer is formed by the slow process of shared experience. A small group with brilliant minds and aggressive spirits often conceives a plausible goal. From this beginning the idea spreads. Slogans are formed, and the public is deluged with catch-phrases and promises. Hand in hand with his active promotion, an aggressive enemy tries to silence his opponents.

Bill Would Have Abridged Freedom of Speech

In the past session of the Washington State legislature, a few lawmakers introduced a bill that would have made it illegal for any official or employee of a private company to criticize a PUD, or its rates; to infer socialism, or say anything to stir up discontent among customers or cause voters to reject a PUD under consideration. The penalty would have been two years in prison and up to $5,000 fine for the convicted spokesman. This bill did not get far.

Is it possible for the average citizen to read daily reports, to hear charges against private utilities without believing some of them? The truth is the consumer is not too much concerned. I am convinced these consumers are not enemies of big business, that they are basically fair and honest, that they will not be deceived if given all the facts.

A 1955 public opinion survey showed a favorable trend toward business management had increased in the past 12 years, while opinion favoring government ownership had gone down. True, people would like continued government regulation, but most say rates are reasonable and service good. People are convinced socialism would be bad. After the last election, two careful surveys were conducted in Washington and Oregon. In Washington, only 16% of those questioned said power influenced their vote for U.S. Senators. Only 5% said power influenced their choice of Congressmen. Only 23% said the federal government should do all the dam building in the Pacific Northwest, and 53% favored private industry's going ahead with its construction program. About 85% thought electric costs satisfactory, while 11% were critical. Only 15% favored government ownership of the electric industry; 45% favored private operation.

Industry Not Presenting Its Facts Well

Are the people getting the facts? I must say that private industry is not doing so well in this respect. Three important rules are working against us: (1) Never call an idea or program socialistic—talk about pensions, health, insurance, welfare; (2) Launch the program a bit at a time—don't frighten the people by showing the whole program at once; (3) Assure the common people their rights will be protected.

So public power advocates conceal their real motive today. They talk in terms of comprehensive river development, the global race for power, the industry-attracting value of low-cost electricity, and democracy which restores resources to the people.

I would like to recommend three steps which should improve consumer understanding: (1) Pay closer attention to the needs and wishes of customers. Our first obligation is to continue to live right and to keep our houses in order. (2) Resolve to shake hands actually with customers. Encourage officers to speak before PTA groups and television cameras.

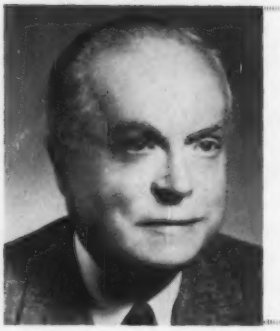
Unless we are willing to talk with more people about our problems, we can never achieve understanding. (3) Promiscuous name-calling does not gain too many advantages. We must leave the door open to potential friendly allies. We cannot afford to widen the gulf of resentment and distrust that comes by name-calling. One never knows whether a vote for public power yesterday will favor private management tomorrow. We should work with everyone who will sit down with us.

When it comes to the extreme advocate of public power, I recommend that we take him on. I believe we should put the spotlight upon the individual who promotes a partisan view and explain just why he's doing it. The longer we let these special pleaders get by with it, the bolder they become.

The public is on our side to start with. It desires security and peace. It is not ungrateful for the advantages provided by industries.

Our one big problem is to get closer to the public. We must explain our goal simply and conscientiously.

Companies Are 'Publicly' Owned



T. D'ARCY BROPHY,
Ch, Kenyon & Eckhardt, Inc.

"Public utilities are . . . in effect . . . contractors to the public, whose contracts come up for review periodically; whose rates are regulated; whose books are audited by public accountants; and who annually must account to their owners, the shareholders"

In attempts to sell a better understanding of our economic system, it is necessary to be even more skillful than in the field of politics, for we are entering upon areas of legitimate debate and are in competition with the proponents of big government, planned economy, and all the other shibboleths that would lead us away from free enterprise.

Much of what has been given the people in the past has not been directed—not genuinely directed—to showing them their own interests. Accordingly, it has been discounted as special pleading. Some woeful examples, I think, have been in the controveries between management and labor. The union sets forth an advertising blast that presents a very colored picture of its side of the conflict. Too often, the company replies in kind. The public reacts negatively to all such special pleadings.

Are Utilities Privately Owned?

Contrast such advertising, in which the noise of the axes on the grindstones came through too clearly, with the single advertisement Robert Young ran during the controversy over through-railroad service to the Coast: "A hog can cross the country without changing trains, but you can't." Next day there were editorials all over the country, and within hours, the New York Central and Pennsylvania promised through-car service.

Is there such a thing as a privately owned utility—unless it's the farmer who owns a Delco set. Is yours not a publicly owned business?

I wonder if the public might not have a different attitude were the distinction drawn between public ownership—by many thousands of shareholders—and government ownership. A campaign of public persuasion to win appreciation for our great publicly owned utilities—and by that I mean America's power companies—as against the creeping threat of government gobble, should be not only your privilege but your high duty.

Public utilities are often called monopolistic; but in effect, they are more nearly contractors to the public, whose contracts (franchises) come up for review periodically; whose rates are regulated; whose books are audited by public accountants; and who annually must account to their owners, the share holders, on the conduct of the business, and of course to the government for taxes.

What Are The Real Monopolies?

In contrast, government-owned utilities are, fundamentally, full and irrevocable monopolies who do not need to renew their franchises; have no tax problems; make no comparable accounting to the public; and are not audited by outside firms.

Furthermore, the publicly owned utility—and again I mean the company—is constantly under pressure from the government and the public to keep rates down; from suppliers and labor to pay more for materials and manpower, from the stockholders for larger dividends; and from the future to provide for growing needs.

Government-owned power operations are virtually free from these pressures, and the public should be aware of the difference.

Next year our high schools will begin to graduate record numbers of students—and shortly, we will have record numbers of new voters. In a relatively short period, the number of young voters will begin to outweigh the number of older voters. The educational job that must be done on private ownership and free enterprise will be much greater in the years immediately ahead.

It is important to know what today's young people are thinking and what the nature of our educational job may be for the future. Then we must make them fully aware of the issues.

If I have said anything that can be of help, it is concerning the manner by which this task is approached. Advertising can be useful. Do it one way, and you will find that it will not help, and it may prove to be a most expensive way of talking to yourselves. Do it another, and millions of Americans will stand beside you.

I have never been an advocate of the "keep your head down" school of public relations. If I have any understanding of our American public I know that it loves a fighter for a just and honorable cause, a cause that is persuasively presented in terms of its own interest and the welfare of all.

Politics vs Hoover Commission

DR S. C. HOLLISTER,
Dean of Engineering, Cornell University

"What will come from the broad policies arrived at by the Hoover Commission? It depends on whether statesmanship prevails, and whether we as vitally interested citizens, who will have to pay the huge bill, will allow the Congress to deal with this objectively."

In 1953 Congress created the second Hoover Commission, a bi-partisan group of 12 men, headed by former President Herbert Hoover, to examine into the efficiency, policies, and function of the executive branch of the federal government, and to report back to the Congress in the spring of 1955 with recommendations for (a) reducing costs, (b) increasing efficiency, (c) getting the federal government out of business enterprises.

Federal Policies Judged on Non-partisan Basis

The commission, with the aid of a Task Force on Water Resources and Power, made the most comprehensive fact-finding report ever made on the federal government's functions in this area. The commission made a series of recommendations to Congress which amount collectively to a statement of recommended policy. There was thus provided a non-partisan basis for judging the policies and functions of the federal offices and agencies in this field.

It is often said that the Hoover Commission has recommended that TVA be abolished. This is not so. The commission has recommended, however, "that the Congress empower and direct the Federal Power Commission to fix the rates on government power sales at such a level as will (a) eliminate the inequities now imposed upon the great majority of the people; (b) amortize and pay interest on the federal investment in power, plus an amount which will equal federal exemption based upon the federal taxes paid by the private utilities; and (c) provide payments in lieu of full taxes to the state and local government equivalent to those the private utilities would pay." In the meantime, until these matters are finally resolved, further expansion of the TVA territory of operations should be prohibited.

The task force summarized the costs of all federally financed power projects built, building, and authorized as of June 30, 1953, at $9,663 millions. There are 19 states that will receive no power from these plants, but which have paid, or will pay, 61% of the cost of the program if it is allowed to be carried out. Only about one-third is now spent. The people of many states are actually being obliged to pay money into the Federal Treasury that will be used to take their business and prosperity away from them. Such an anomalous situation results when the federal government competes in business with its own taxpayers.

Unfortunately, we have had men elected whose activities consisted largely of selfishly obtaining special benefits for their constituents at the expense of all the people, and who have used such gained benefits as a justification for keeping themselves in office. The electorate themselves are responsible for this prostitution of public trust, by adopting the attitude that it is right that they should get from the public treasury all they can for themselves.

It must be evident from the foregoing that with the large number of agencies of the federal government involved, there is overlapping responsibility, competition between agencies, competition with—and in some areas replacement of—private enterprise, and an inequitable use of the taxpayers' money. There is lack of consistent policy as between the functions of the agencies involved. Likewise, in the competitive and politically-charged atmosphere of bureacratic operation, there is a grave threat to arrival at sound solutions to the many urgent problems respecting water resources that beset our nation, in which the right decision rather than the most politically expedient decision must be made. Two things are thus needed: (1) a sound and continuing, non-political national policy respecting water use, and the federal government's role therein, and (2) adequate machinery to aid the president to make effective this determined policy.

Recommendations Support President's Policies

An analysis of the commission's recommendations shows that they support to a remarkable degree the policies stated from time to time by the president.

What will come from the broad policies put forth by the president and independently arrived at by the bi-partisan Hoover Commission as sound long-range policies? It depends on whether statesmanship prevails, and whether we as vitally interested citizens who will have to pay the huge bill, will give the kind of support that will offset the pressure groups, the seekers of handouts, and the demagogues, and allow the Congress to deal with this issue objectively and in the best interest of all the people.

What Do The People Think?

DR CLAUDE ROBINSON,
Pres, Opinion Research Corp

"People need more facts, but the industry must show how the facts touch the average man's own self interest . . ."

Sentiment for business ownership of the electric power industry has been rising over the past 15 years. In 1941 our nationwide study showed that 41% of the American people favored business ownership. Today this has risen to 56%. The public believes that business-managed companies give better service, but that government plants provide electricity at lower rates.

Our research also discloses great public ignorance about the facts of this vital industry. Only 17% of the public knows that city-owned electric systems do not pay federal taxes. Seventy-seven percent say they should. Only 13% know that federally owned power plants give preference to municipal electric systems, but 69% say that all groups should have equal chance to purchase and use this power.

But our own and other public opinion surveys have clearly shown that it is not enough for an industry or an organization merely to do a good job or perform a beneficial service at a reasonable price. It is necessary to go a step further: You must tell the public about it.

Information and communication are the keys to an effective industry public relations program. People need more facts, but the industry must show how these facts touch the average man's interest. If people have a clear understanding that they are now required to help pay the electric bills of others, sentiment for public ownership will continue to fall.

One of the most promising avenues of communication is the electric company employee who becomes an ambassador for private ownership.

FPC Busy on Hydro Bids

ARTHUR KLINE,
Commissioner, Federal Power Commission

"Pending before the FPC as of Jan 1 were applications for preliminary permits and licenses totaling about nine million kw."

During the four-year period which ended June 30, 1956, the total capacity of applications filed with the Federal Power Commission exceeded 18 million kw. This is far greater than the amount of capacity applied for in any like period in the past 30 years.

It is more than twice the operating capacity in all of the 238 projects now under license. During this same four-year period, the ultimate capacity under license increased from about 9 million to 15 million kw and the operating capacity from 5.7 million to 8 million kw.

New capacity being constructed under FPC authorization at the present time totals about 6 million kw, of which about 3.4 million kw in nine projects are public developments and 2.6 million in 26 projects are private developments.

Pending before the commission, as of Jan. 1 of this year, were applications for preliminary permits and licenses totaling about 9 million kw of hydro capacity.

This increase in licensing activity has occurred in all sections of the country. Projects of particular interest which are under license or consideration by the FPC include:

In the Northeast, the St. Lawrence and Niagara.

In the Southeast, the Coosa River project.

In the Southwest, the Markham Ferry project.

In California, projects on the Feather, Stanislaus, San Joaquin, and Kings Rivers.

In the Columbia Basin, such projects as Priest Rapids, Rocky Reach, Swift Creek, Cowlitz, Pelton, the Snake River projects and Noxon Rapids.

Statism Moves on Many Fronts

LEONARD E. READ,
Pres, Foundation for Economic Education

"You can't admit the propriety of price supports to farmers, government housing, government loans to foreign countries, government delivery of mails, or subsidized navigation aiming at lower priced coal without making the case for government light and power."

Government is nothing more or less than individuals organized into a compulsive apparatus—individuals no more immune to affluence and power over others than the rest of us. But, having a monopoly of force at their command, they discovered that they could intrude into the creative activities and the productive enterprises which citizens had reserved for themselves. And they found that they could, by the use of force, collect the wherewithal to make up deficits.

Socialism or communism has grown in our homeland to the extent to which government has departed from merely inhibiting destructive actions and assumed control of creative actions. To that extent have private property, free market, and limited government concepts and practices been destroyed.

Government's Take Increases

A little more than a century ago the average citizen had a 95 to 98% freedom of choice with each income dollar. The take of government—federal, state, and local—was 2 to 5% of all earned income. But as government entered into enterprise after enterprise, assuming more and more responsibility for the citizens' welfare, the take increased. Today it is about 33%.

The cell in the body politic having such a capacity for inordinate growth and giving rise to the social cancer, is the belief in organized police force controlling the creative activities of the citizens. Once we relied on private enterprise if we wanted a house. We relied on the person who wanted to construct it. We relied on the one who wanted to lend money for tools, labor, material. Under this system we built more housing per person in this country than ever existed anywhere.

Yet, more and more people today believe that the only way to obtain adequate housing is to use force to take earnings from some and give them in the form of housing to others. We have here the application of the Marxian ideal: "From each according to his ability, to each according to his need."

This Faith Must Be Renewed

Now I actually believe that you can control better than I can your own creative actions. But reflection reveals this to be a view so radical that few persons share it. Yet it is the faith that must be renewed where lost and discovered where it is unknown.

You in the power and light industry must not remain idle except when socialism is dimming your own lights. Socialized housing, farming, medicine, or whatever requires the same alertness on your part. Would you be less alarmed were your physician to report that you had cancer of the large intestine instead of the brain? The belief in force as the means of creative accomplishment is of the same order. It matters not where it manifests itself; all else in the body politic is threatened thereby. You cannot admit the propriety of price supports to farmers, government housing, government loans to foreign countries, government delivery of the mails, or subsidized navigation aiming at lower priced coal without making the case for government light and power.

Such Is Socialism's Ally

The exception maker is socialism's only ally. There isn't a sane man who is a consistent socialist. It ought to be clear how woefully ineffective all of us are who come to life only when our ox is gored. I am reminded of this wise advise:

"If these minority groups would save their own skins and their own souls, they would first fight for the rights of all men; second for the rights of others than their own; and last, if at all, for their own."

May historians a millennium hence, reflecting on this era, be inspired to observe: Men, bearing heavy responsibilities, suddenly became acutely conscious of society's mad rush into political giantism. Instead of trying to reform others they perfected their own understanding, their skills of exposition to the point where great numbers sought their counsel and heeded their words. They became leaders by becoming intellectually and spiritually attractive. Thus they replaced the pseudo leaders whose only tool had been might.

And later generations, appreciating that they had come to the aid of their country in the nick of time, hailed them as "the good builders" and "the practical men of the 20th century."

A Fair Return Must Be Earned

H. LESTER HOOKER,
Commissioner, Virginia State Corporation Commission

"Utilities cannot be required to serve the public without just and reasonable compensation. To do so amounts to the taking of private property for public use without just compensation or without due process of law."

A public service commission that fails to permit a utility to earn continuously a reasonable and fair return is not properly protecting those who use and depend on regulation to see that they receive efficient and dependable service.

Utilities cannot be required to serve the public without just and reasonable compensation. To do so amounts to the taking of private property for public use without just compensation or without due process of law. This is the legal safeguard for the protection of utilities which might, if not so protected, fall prey to some who for personal or political gain might disregard the utility's investment.

State Regulation Must Be Fair

The right of the State to regulate public utilities or public service corporations whose business is monopolistic, affected with a public interest, is based on the general police power of the State, but the exercise of such power must be reasonable and avoid a taking of private property for public use without just compensation. These fundamental principles are necessary essentials in the plan of utility regulation.

Only in the U. S. are the public utilities so much under the control and operation of private ownership. This is a strong indication that state regulation of privately owned utilities has succeeded so satisfactorily in the public's mind that the continuation of the privately owned utility under state regulation is in the best interest of the public.

Judged by actual performance, it must be admitted that the overall results of our system have served the public well. This excellent record has not been due entirely to regulation. It is the manifestation of the success of the free enterprise system.

I am a firm believer in complete regulation of the electric power industry. On the other hand, I am just as strongly opposed to government ownership or operation, whether state or federal.

Under the present system of regulation the public is fully protected as to the rates which these companies are charging. The history of the industry is the best evidence of the efficiency of service under private management, publicly regulated. This is quite different from government ownership which is not regulated by any impartial agency.

Those who claim that the comparison of such operations is a fair and reasonable yardstick, have a strange and peculiar quirk of fairness. Such opinions give me a depreciated value of their views, and might well lead to a devaluation of their sincerity.

No industry has contributed more to the alleviation of toil, to the increase of commercial activity and productiveness, and improved the standard of living, than has electricity. One of the greatest factors in the rapid changes which have taken place within the recent past is the electric light business.

Private Ownership of Utilities Is Best

Private ownership and operation under proper public regulation is the best way to conduct the business of public utilities, in order that the public may receive the best overall benefit. This method encourages business-like operation. Private ownership conducted under reasonable regulation, having due regard that the industry has a dual nature—private, so far as the stockholders are concerned, and public, so far as the public is concerned—have made America preeminent in the field of public utility service.

A learned jurist once said: "It has been found better to let the natural laws of economy and society prevail and to leave ownership and operation of public utilities under proper regulation, in the hands of men whose lives have been spent in the operation of these utilities, and whose education and long practice have made them expert in this highly specialized business."

It is the obligation of private industry by its initiative, ingenuity, and business acumen to serve its customers as economically as possible, and the federal government should not be a party to any plan that would prejudice the public against private industry, in its sincere endeavor to serve the public needs adequately and at reasonable cost.

It behooves everyone who believes in states rights and private enterprise to be at all times eternally vigilant to protect and defend their preservation.

Low Interest Rates Inflationary

ALBERT H. GORDON,
Partner, Kidder, Peabody & Co

"If an attempt is made to recreate artifically low interest rates, the increased inflationary pressures may well result in a reappearance of the rate of depreciation of the dollar which took place during Roosevelt and Truman Administrations . . . that would be bad not only for you but for the great majority of the people."

Your industry has come of age. The improvement in its financial status in the last 20 years is graphically illustrated by the substantial upgrading of the ratings of your bonds. Moody's classified 20% of the bonds as substandard and 22% as Baa in 1937. By 1957 all the Ba ratings had disappeared and the percentage of Baa bonds had shrunk 12½%.

We have direct knowledge of the excellence of your industry stockholder-wise. We have benefited by the high quality of your performance. Though we tell our customers to whom we have sold your common stocks, that we have done well for them, confidentially we admit they should thank you.

This record, if continued, insures your ability to obtain the additional funds necessary to supply the seemingly ever-increasing demand for electricity, provided inflation and the resultant continued depreciation of the dollar do not inhibit the custom of so many Americans to invest in fixed-income securities through their selected investment channels.

Inflation Is a Threat

Threat of inflation exists today in practically all parts of the world. It has greatly increased the demand for capital in this country as well as others, but it has not correspondingly increased the supply of savings. The saver who has seen the purchasing power of his dollar decrease 57% since 1939, as measured by the Bureau of Labor Statistics Index of Wholesale Prices, is discouraged from investing in fixed-income securities and many potentially thrifty people are not saving at all at the present time.

Yields on your newly issued "A" bonds today are more than 1% higher than they were on such bonds 12 months ago (3.70 to 4.75% plus). Yields on common stocks, measured by the Dow-Jones averages, have not increased.

Let us not take it for granted that 30-year money will always be available at some reasonable rate. With at least half of your capital funds derived from the issuance of long-term debt securities, no one should be more interested in the containment of inflation than utility managements and their stockholders.

If interest rates are allowed to move in response to economic factors, the supply and demand for funds should balance out. But if an attempt is made to recreate artifically low interest rates, the increased inflationary pressures may well result in a reappearance of the rate of depreciation of the dollar which took place during the Roosevelt and Truman Administrations. And that would be bad not only for you but for the great majority of the people.

Three Factors To Be Weighed

Three factors the investor weighs in considering an investment in the industry are:

(1) Growth and development of the business.
(2) Regulatory attitude, and
(3) Management incentives.

On growth and development investors have been attracted by the ability not only to produce electricity for a growing population but to sell greater amounts per capita. Investors have been impressed that some of the increased gross has been carried through to earnings available for dividends.

Only recently has the sophisticated investor begun to realize that the electric industry is one of outstanding growth. Earlier one fear had been dissipated when he learned that the industry could protect itself from rising costs by modest rate increases, including automatic operation of fuel clauses in some areas, and improved operating efficiency.

Secure Rates of Return

On regulatory attitude for companies to attract sufficient capital on advantageous terms, it is essential for them to secure rates of return which will result in market prices for their common stocks above their book value.

To sound growth and regulation must be added competent management. Without it the industry cannot progress, cannot resist the attacks of the subsidized power lobby, and cannot take full advantage of technological improvements.

What EEI Speakers Said

Wanted: Engineering Teachers

DR CURTIS L. WILSON,
Dean, School of Mines, U. of Missouri

"This civilization, in order to survive, needs engineers to prevent disintegration from within or without. The supply of engineers must come from engineering colleges, the most important component of which is not buildings, laboratories, equipment, nor curriculum, but teachers."

H. G. Wells said that civilization is a race between education and catastrophe. That statement might well be amended to say that civilization is a race between engineering education and catastrophe.

Industrial companies throughout the country are interested in attracting more men and women into the engineering profession, not only for the benefit of themselves but for the security of the entire nation. They know what Russia is doing.

Industry is earnestly desirous of promoting engineering education. To improve opportunities in engineering it is offering handsome scholarships to worthy young people, attractive salaries, and favorable and challenging working conditions.

The public utilities of this country provide the power necessary to carry this civilization along the road to survival. Thus every effort should be made to attract young graduating engineers into that industry. The opportunities are most alluring, not the least of which is the opportunity to serve society.

But the problem facing this country is not entirely a dearth of engineering students.

Shortage of Teachers Grows Acute

The real crisis facing engineering education today, shared by industry and the entire nation, is the need for engineering teachers.

The situation with regard to grade and high school teachers is gradually improving, but the lack of engineering college teachers is becoming worse.

Perhaps unknowingly and certainly unwillingly, industry is competing with colleges for engineers. In many instances the deciding factor is salary, and in this respect resources of industry exceed those of colleges.

Professors who remain today on engineering faculties do so because they are persons dedicated to serving young people at great sacrifice to themselves and their families. America owes much to them, for behind every great engineer or scientist stands a great teacher.

I venture now to make a suggestion intended to be wholly constructive. The great power companies need young engineering graduates. Your companies are therefore anxious to help engineering colleges. Engineering colleges need teachers. They cannot today provide salaries adequate to retain them.

Many colleges retain at least a certain number of their faculty members by securing research projects sponsored by industrial companies or federal agencies which provide funds from which extra faculty compensation is secured.

How Utility Aid Could Be Mutually Beneficial

For electric power utility companies another method seems more applicable. If utilities could offer some sort of consulting work to faculty members, it would augment their salaries, increase their knowledge and therefore their usefulness as teachers, and enhance their prestige in the eyes of their students.

It could not help but direct the attention of many of their students to the attractive opportunities in the field of electric power, which to date have scarcely been noticed. It might also bring some beneficial results to the companies, although not too much should be expected at first.

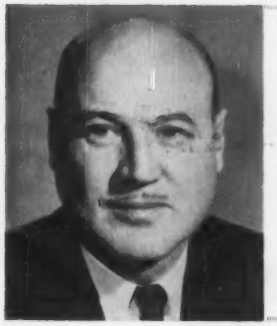
Such consulting work might be offered first to electrical and mechanical engineering faculties, or to teachers of any other disciplines which might be of service, such as physics or mathematics. Lower academic ranks, such as assistant professors, seem to need financial help the most, and the consulting fee or retainer need not be of outlandish magnitude.

The services rendered during the academic year might be of the type that can be carried on by correspondence or telephone calls, supplemented by plant visits several times a month. Then work during the summer might well be mutually beneficial to the professor and the company.

This country needs engineers now and will continue to need them for many years to help produce and use the electric power required now and in the future.

This civilization, in order to survive, needs engineers to prevent disintegration from within or without. The supply of engineers must come from the engineering colleges, the most important component of which is not the buildings nor the laboratories nor the equipment nor the curriculum but the teachers.

Atom Partnership Works Best



K. D. NICHOLS,
Engineering Consultant, Wash. D. C. Former AEC Gen Mgr

"I am personally convinced that it is to the best interest of the United States that a cooperative program be continued and that there be no back-sliding toward the government monopoly that existed previously"

The 1954 Atomic Energy Act, although it permits and encourages free enterprise to assume greater responsibility for the development of atomic power, does not turn the job over completely to private utilities but, in effect, requires a partnership to exist between government and free enterprise. I believe it desirable to continue and to expand this partnership between the government and free enterprise. At the same time, however, we must redouble our efforts to have free enterprise assume as much responsibility as is consistent with the state of the art.

Progress Has Been Made

The progress we have made in all aspects of this new atomic industry has been very encouraging. The response of private enterprise and the responsibility assumed by private enterprise in this partnership program have been a most gratifying demonstration of the merits and boldness of our free enterprise system. I am personally convinced that it is to the best interests of the United States that this cooperative program be continued and that there be no back-sliding toward the government monopoly that existed previously.

Our present program for reactor development is based on advancing on a broad front in order to insure that ultimately we will have developed the most economic type of reactors for the various applications in our overall power program. Nuclear power plants using pressurized water, boiling water, sodium graphite, and fast breeder reactors are being or will be built.

There is every reason to believe that within the next two years it should be possible to start construction of a pressurized water plant in the order of 200-400 Mw that should be truly competitive with coal-fired plants in the New England area or comparable cost area. The boiling water reactor and the pressurized water reactor may very well tend to drift together with advantage being taken of the chief merits of each. The third approach, the sodium graphite reactor, may have better thermal efficiency because of the use of liquid sodium as a means of heat transfer.

I personally have advocated development of the fourth type reactor I have mentioned, the fast breeder, for many years. To my mind, the fast breeder project is a necessary, bold, farsighted experiment that promises to be of most importance in the ultimate application of the atom to the world's power needs.

Homogeneous Reactor Has Potential

A fifth approach, the homogeneous reactor, is not as far along as the four I have mentioned but has great potential for the future.

Is this atomic power program adequate for our national needs? If one considers only internal economic factors for the United States, the program may be adequate. However from a political point of view there is a demand to accelerate further the development of atomic energy beyond that strictly dictated by United States' economic considerations. The strength of this movement derives from those who feel that from an international point of view we must maintain our leadership for prestige purposes, or as a part of our overall economic aid program we must assist Europe and other friends in achieving economic atomic power. Also, from the point of view of those in the high cost areas of the United States, such as New England, there is the possibility of even higher costs for transporting fossil fuels. As a result of all these factors, I believe the development of atomic power probably will be further accelerated in the United States by one means or another.

Utilities Must Maintain Leadership

Utilities must maintain vigorous leadership in further acceleration of the program. The reasons I advocate this are: first and primary, that it is good business to anticipate a new development and be in a position to understand it and properly exploit it when it materializes. Second, it is only by doing that we can develop engineering improvement, acquire new production techniques, and determine the economic results from increasing the size of our present reactors. Third, atomic power will be competitive in the United States in the higher cost areas within the next decade and it is necessary for the utilities to determine for themselves the true economic limits of this new source of power, and its proper relationship to coal, oil, and hydraulic sources.

Right Attitudes Achieve Safety

ALLEN S. KING,
Pres, Northern States Power Co

"Any safety program that has its motivation in a desire to reduce costs of accidents, win contests, and establish records is doomed to failure. The only motivation with power to carry through to success is the desire to save people from injury and death."

The presentation of safety awards should be and is a highlight of the Edison Electric Institute convention program. Awards deal with significant records of accomplishment in this field of human relations and should serve as an inspiration for all of us.

But there is danger in placing such emphasis on awards. There is danger of losing proper perspective and placing too much reliance upon mechanics of accident-prevention work. There is a temptation to approach safety programs with such a degree of gadgets, rule books, and techniques that the human touch is lost.

Accident Causes Stem from Unpredictable Humans

We have always realized that accidents don't just happen; that they are caused, and that they seem to result from the same general causes over and over again. Why? Because we are dealing with human beings whose reactions are very unpredictable.

It is a person that gets hurt. It is a person, a human being, who must use safety devices and execute safety rules. The fact that he is an individual and cannot be classified with reference to any norm is what creates the perennial problem in accident prevention work. Success in safety work depends largely upon the attitudes of the people involved. Only by developing proper attitudes by each group within the organization can a reasonably successful safety program be maintained, and this is a responsibility of management.

Some attitudes affecting this matter of safety involve:

The Worker—Does he like his work or irk under it? Is he enthusiastically loyal to the company or does he carry deep resentments? Does he consider his boss fair and respect him, or is there unconscious antipathy? Does he think safety programs are aggravations, or believe they are set up for his benefit? Does he have a happy family relationship or domestic worries?

The Foreman—Does he consider himself a representative of management or only a higher paid worker? Does he like management and its policies or is he carpingly critical and prone to express it? Is he sold on the need for safety programs or consider them a waste? Does he believe in and assume responsibility for training new men on the job or does he say "A man learns best from his own mistakes."

The Supervisor—Does he honestly feel safety comes first or does he tolerate rules and practices while concentrating on performance? Does he feel responsibility toward safe job planning or so-called efficient procedures? Is he motivated by human values or the amount of work he can turn out?

Management Attitude Is Foundation to Success

Management's attitude is the underlying foundation for any successful program. Effectiveness can be increased or diminished according to the degree of support and encouragement that management displays. And fundamentally, all safety work must proceed from the proper motivation by management.

Attitudes and motivation comprise the first step in the program. The second is knowledge. The saying "familiarity breeds contempt" doesn't apply because complete knowledge of the hazard removes fear. This leads to safe working methods, tools, and other devices. Management must assume almost complete responsibility in this and engage in necessary research to develop new, safety techniques.

The third obligation of management is to assume leadership in getting the proper story to all levels. The educational approach must be personalized. Techniques should be keyed to dissemination of knowledge of hazards and use of safety devices and work methods.

But all of this loses its effectiveness without proper employee attitudes. This embraces the whole field of industrial relations and internal communication. Workers react to what they read, hear, and see. They react to wages they are paid, hours worked, and other physical conditions. Attitude is affected by home life and is formed to quite an extent outside shop or office. Some of these incidents are beyond the control of management but many are within management's control.

Announced policy is carefully watched and weighed, and has its cumulative effect. Actions of foremen and supervisors, fairness of wages and working conditions all have effect on employee attitudes. One could measure with fair accuracy a company's employee relations by a study of its accident record. There is a definite connection between dissatisfied employees and accident-prone employees. A happy company is a safer company.

New "25" is lighter and smaller

General Electric's new 25-kvar capacitor is 22% lighter and 30% smaller than the former design. On pole-tops, where most 25s are now used, this means a weight reduction of about 16 pounds per capacitor, or nearly 200 pounds for a 300-kvar equipment.

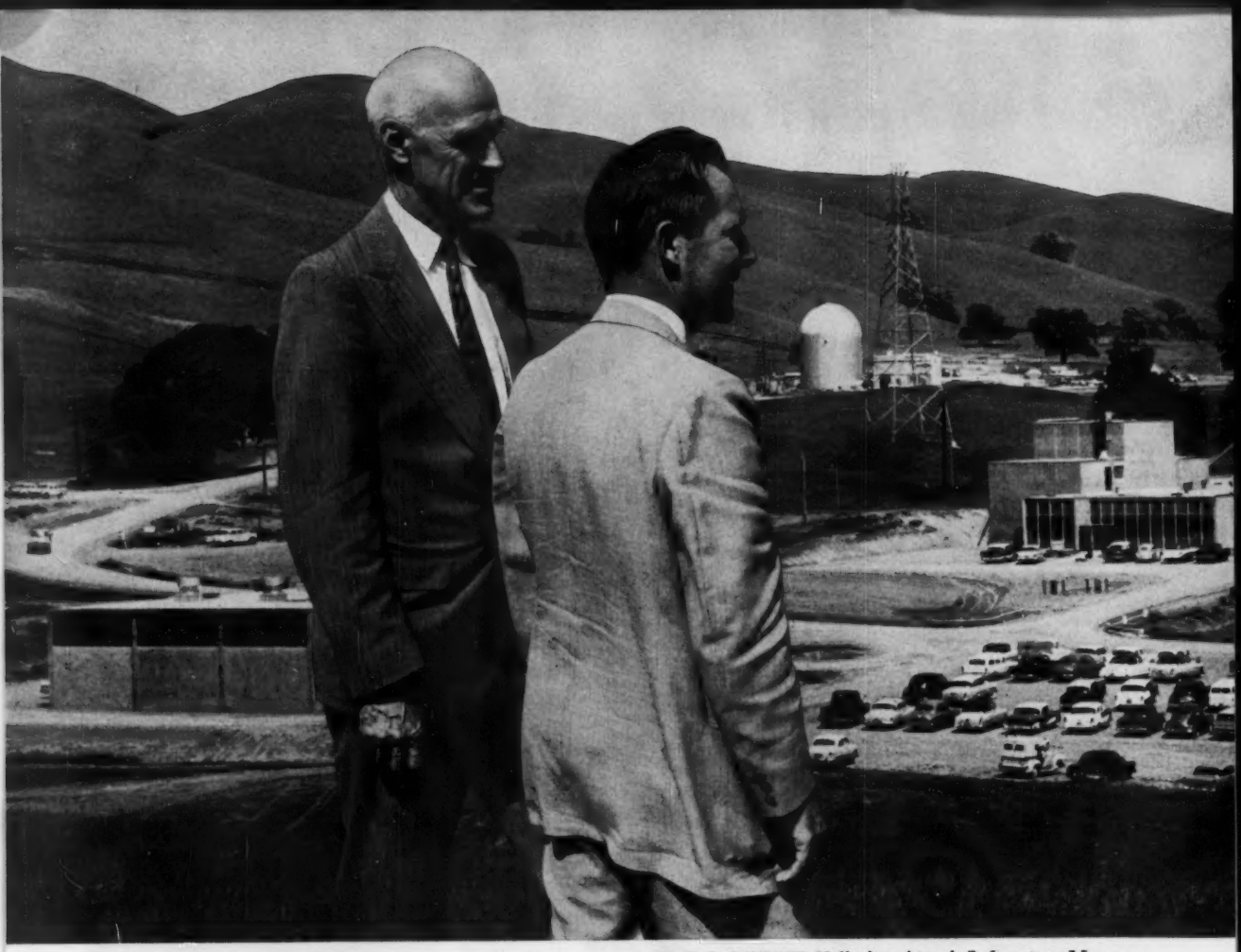
Yet, neither quality nor life have been sacrificed. All that's missing from the new capacitor is bulk. The new light-weight units, made possible by G.E.'s exclusive extra-low-loss kraft paper, are easier to handle, hoist, and install. In fact, a General Electric 25-kvar capacitor can now be lifted easily by one man.

You'll notice that the new unit looks different, too. That's because it has a fabricated case with all the features of the larger 50-kvar capacitor, including new corrosion-resistant case material. The new 25 meets all NEMA standards and in most cases is fully interchangeable with old-style 25-kvar capacitors—for large rack and housed equipments, simple adapters are furnished on request.

That's the basic story. Your G-E Apparatus Sales Engineer will be pleased to supply the details. Or write to General Electric, Section 445-8, Schenectady 5, New York.

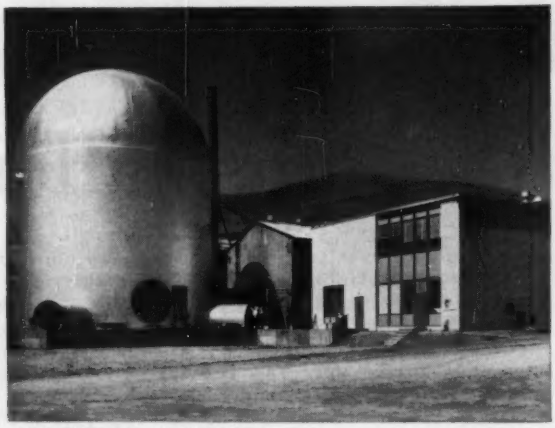
Progress Is Our Most Important Product

GENERAL ELECTRIC

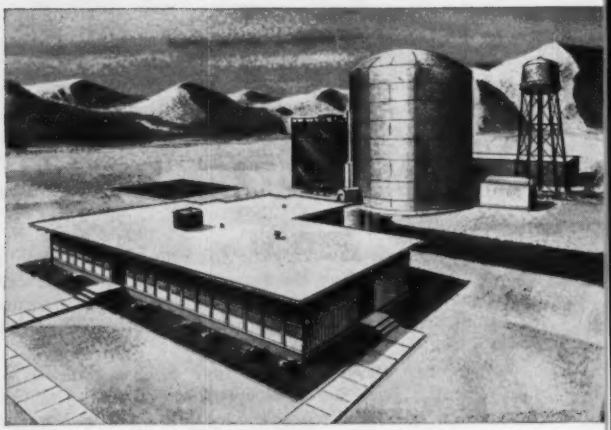


DR. R. D. BENNETT, Vallecitos Atomic Laboratory Manager (left), and **E. P. LEE,** Manager of Plant Operation, view Lab-

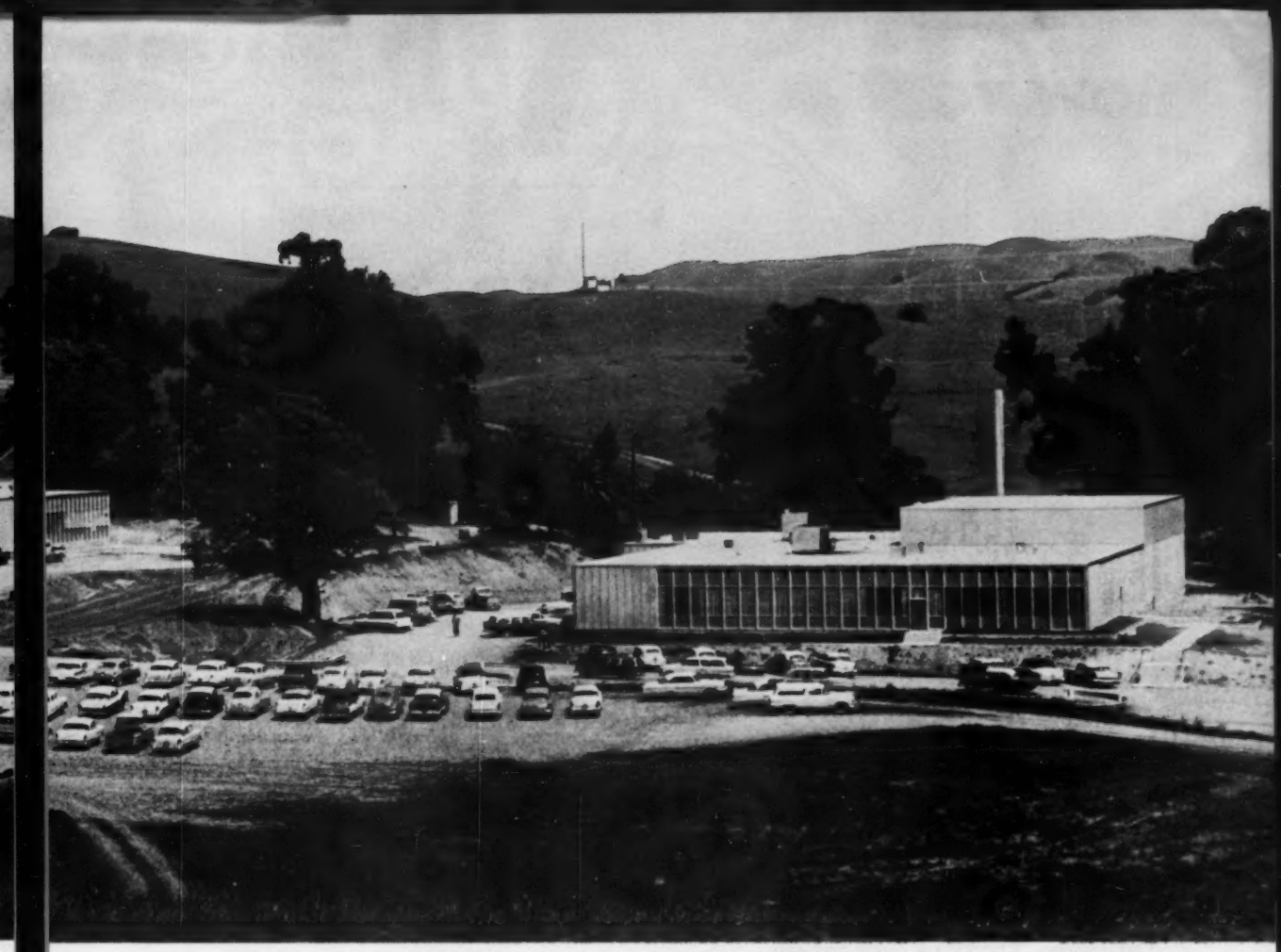
General Electric Vallecitos Atomic Laboratory



PURPOSE OF EXPERIMENTS to be conducted in Developmental Boiling Water Reactor is to develop economic nuclear power. Facility will furnish steam to 5000-kw turbine-generator, owned and operated by Pacific Gas & Electric Company.



GENERAL ELECTRIC TEST REACTOR, planned for completion in 1958, is a new concept in reactor design developed by General Electric. This 30,000-kw test reactor combines features of tank and pool reactor types.



oratory's facilities: Radioactive Materials Laboratory (right), Experimental Physics Laboratory (center), Developmental Boiling Water Reactor (rear). New General Electric Test Reactor (not shown) will be completed in 1958.

will help speed economic nuclear power

LABORATORY IS NATION'S LARGEST PRIVATE NUCLEAR RESEARCH FACILITY

Progress in private industry's determination to reduce the cost of nuclear power was made May 22 when the new General Electric Vallecitos Atomic Laboratory at Pleasanton, Calif. was dedicated.

At Vallecitos, advanced research and development facilities will be utilized to help accelerate the practical application of atomic energy.

The Radioactive Materials Laboratory will be used to study irradiation effects on reactor fuels, components and structural materials. These studies will lead to improved reactor technology.

The Experimental Physics Laboratory contains a critical assembly which will be used to study reactor core configurations and fuel loadings. A Nuclear Test Reactor will also be used for general physics experiments and calibration.

The Developmental Boiling-Water Reactor, to be completed later this year, will be used to develop important research data on power reactor systems.

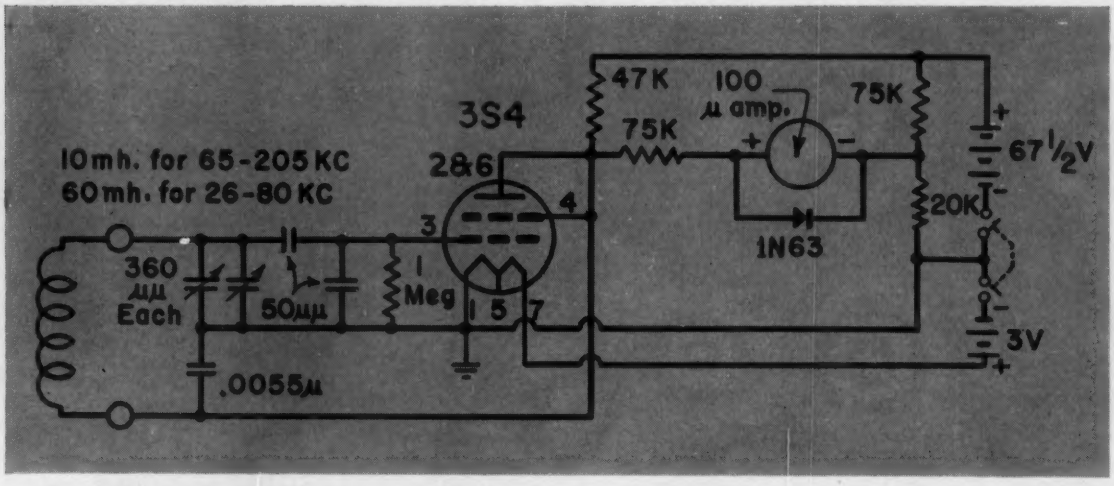
A General Electric Test Reactor (GETR) will be added next year to test materials and components for the Company's nuclear projects.

The multi-million dollar Vallecitos Atomic Laboratory represents another significant step taken by private industry in developing practical applications of atomic energy. Atomic Power Equipment Dept., General Electric Co., San Jose, California.

197-5

Progress Is Our Most Important Product

GENERAL ELECTRIC



RELAYING & PROTECTION—Maintenance

Grid-Dip Oscillator Helps Tune Line Traps

A. G. THORNTON, JR, Electronic Engineer, Appalachian Electric Power Co, Roanoke, Va.

A compact carrier-frequency grid-dip oscillator has been constructed for Appalachian Electric Power Co power-line carrier work in this division. It is used for tuning line traps where power is not available for test equipment. Checking is quick and easy.

Known commercial grid-dip oscillators require ac power and are not suitable for frequencies below 225 kc, and modification of such units was not considered practical.

Sensitivity of the trap-frequency indicator has been found excellent and unaffected by the diode shunting the meter. When the meter polarity is as indicated in the drawing, a meter dip corresponds to a grid-current dip.

In checking the frequency of a line trap (indicated by a meter dip when the knob pointer is turned slowly through the frequency range) the meter must be closely observed. Otherwise the dip will be passed over unnoticed because of the difficulty of coupling the device coil with the trap coil. For this test the device coil is placed tangent to the line-trap coil just outside the outer turn at the "active" end of the trap.

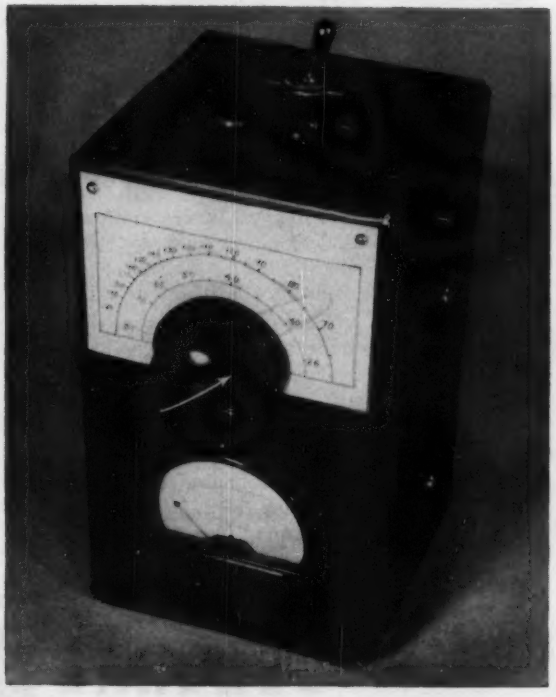
Coupling with shorted turns or turns not within the trap part of the coil must be avoided. For accurate results the trap-frequency indicator coil is moved away from the coil in the tuned circuit until the dip or rise is just barely noticeable.

Besides its primary use as a trap-frequency indicator, this compact self-contained device may be used for the following purposes:

1. As a Signal Generator. By holding it with plugged-in coil in the vicinity of a receiver, the frequency of the incoming signal can be identified by heterodyning. With the coil close to the line-tuning coil or input tank, enough signal is induced to tune the receiver whose selectivity can also be checked.

2. As an Absorption-Type Wave Meter where a substantial rf field is present. By coupling it loosely with an energized circuit, such as a line-tuning coil in an

(Continued on page 120)



APPLIED RESEARCH "Demonstration streets" at General Electric's Hendersonville, N.C., plant permit study of lighting problems on all classes of streets, under all light sources, and for different pavements. Here, Justin Peterson, manager of advance engineering, supervises a light measurement reading of a mercury vapor system on the "main business" street.

You get the results of continuing research in every General Electric street lighting system

Your new General Electric street lighting equipment resulted from yesterday's G-E research findings. And your benefits from today's research will show in even higher quality lighting soon.

Highest value for your street lighting dollar is assured by industry's newest and most complete laboratory, development, and proving facilities. For example, you can compare equipment light output and distribution from the work of a fully equipped photometric laboratory.

On four full-sized demonstration streets, application experiments are carried on for information on present products and projects for tomorrow. Tests are run for customers, at their request, and a trained, professional engineering staff devotes all its time toward improvements to serve your present and future street lighting needs.

Continuing research by General Electric has made major contributions in available equipment and future tools to better serve your public lighting program.

VISION-ENGINEERED SYSTEMS

Let G.E. help your street lighting program on a *vision-engineered system* basis. On every lighting project, regardless of size or type, General Electric offers you, in addition to research and development leadership:

PROJECT RESPONSIBILITY—one source of supply for *all* your street lighting needs. This includes full lines of filament, mercury, and fluorescent luminaires, and a complete selection of control and auxiliary equipment.

COMPLETE APPLICATION ASSISTANCE—expert start-to-finish aid from field and factory lighting specialists.

Get the full *vision-engineered system* story from your nearest Apparatus Sales Office or authorized agent! General Electric Co., Schenectady, N. Y.

LIVE BETTER ELECTRICALLY

452-170

VISION-ENGINEERED STREET LIGHTING SYSTEMS

GENERAL ELECTRIC

RACEWAY TO EXTINCTION

Concentric ring gaps in the new G-E Magne-valve Distribution Arrester whirl the power-follow-current arc to extinction in less than a half cycle, as shown in the high-speed photo above. Rotating action is produced by magnetic flux, as the current flows in coils sandwiched between the gap assemblies. This magnetic action, combined with the valve action of Thyrite* disks, gives Magne-valve distribution arresters their high protective efficiency.

*Reg. Trademark of General Electric Co. for molded resistance material.

Proved Magne-valve principle used on General Electric station and line arresters permits

SMALLEST AND MOST EFFICIENT VALVE-TYPE DISTRIBUTION ARRESTER

The proved magne-valve action has been packed into the smallest, lightest, valve-type distribution arrester on the market today. Some ratings are as much as 40% smaller and lighter than other makes because of the new space saving concentric ring gap design, shown on the opposite page.

Much greater protection is given by these new General Electric distribution arresters—the highest degree of protection ever offered for distribution circuits. The protective level and thermal endurance has been assured by high current tests at 100,000 amperes (5 x 10μs wave), ASA standard duty cycle tests and long duration discharge tests.

Combined valve and magnetic action, of the Magne-valve principle, assures ability to handle lightning discharges with positive extinction of the power follow-current arc after discharge.

Ratings from 3-kv through 18-kv are available in either the external-gap type or direct-connected type with ground-lead disconnector. Both types provide **positive line lock-out protection** and both are universally applicable, anywhere on the system.

For full details on the new line of distribution arresters, contact your nearest G-E Apparatus Sales Office or write to General Electric Co., Section 432-24, Schenectady 5, New York. Ask for Bulletin GEA-6379.

Magne-valve arresters for every application R. W. Frahm, Manager of Marketing—Lightning Arrester and Cutout Section, displays representative samples from the complete G-E Magne-valve line.

Progress Is Our Most Important Product

GENERAL ELECTRIC

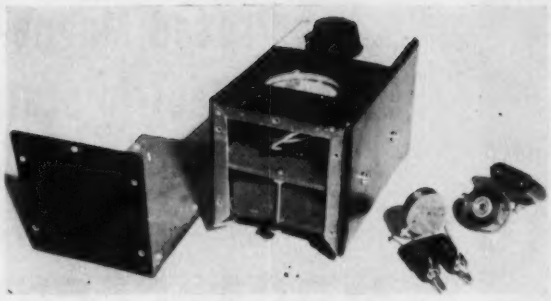
Helps Tune Line Traps

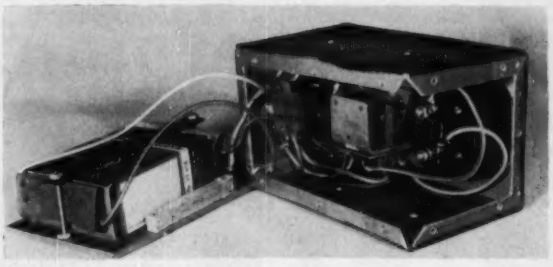
(Continued from page 116)

outdoor tuning cabinet or transmitter tank, the frequency is indicated by a meter rise as the dial is turned across the existing frequency. Loose enough coupling should be used so that a single rise is produced on the meter. Within a strong field, the toggle switch on the device can be turned to the "off" position to obtain a negative reading when the dial is turned past the existing frequency.

3. As a Grid-Dip Oscillator. With the coil of the device coupled to the coil in a parallel-tuned circuit, the resonant frequency will be indicated by plate-current rise or meter dip, corresponding to the grid-current dip, when the dial is turned past the resonant frequency. Hence the frequency of a transmitter plate tank can be quickly checked or roughly tuned by holding the device, set for the desired frequency, close to the tank coil and watching for a meter dip while the tank is tuned. A trap on a panel may be checked or tuned in the same manner.

Any parallel-resonant circuit can be checked or tuned when this indicating device is sufficiently coupled with its field. The frequency can be determined within 500 cycles at any point on the dial. This accuracy is certainly good enough for a quick, easy check. For greater accuracy, the time and trouble of setting up more elaborate test equipment is warranted.





The accuracy of the dial can be a limitation where standard frequency (one with which the indicator can be zeroed) is not available.

TRANSMISSION—Operation

Soil Injection Kills Woody Plants at Low Cost

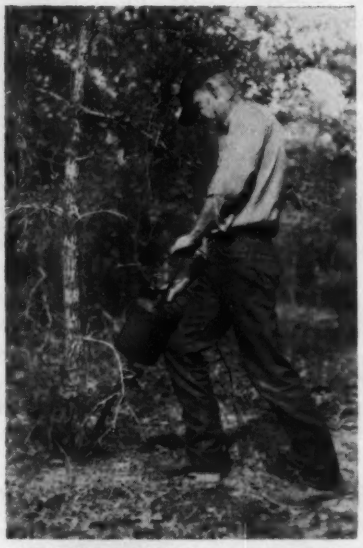
WAYNE G. McCULLY, Assistant Professor, Agricultural and Mechanical College of Texas, College Station, Texas.

Soil injection promises to be a new effective, low-cost technique of clearing utility right-of-way.

Injections of herbicide solutions in soils adjacent to the base of plants have proved effective in killing woody plants up to 8 in. in dia. The per-tree cost of treatment with soil injection, based on three years of experiments, is about 60% of that of basal treatment for stems of same diameter.

Tests indicated that 2 oz of solution is required per inch of stem diameter. A pre-measured dose of the solution is applied with a soil-fumigating gun on opposite sides of trees less than 6-in. dia.

Trees over 8-in. dia, however, failed to respond to the basic volume of application injected at four points around the base. This may mean that younger trees are more sensitive. Or, more care may be required in spacing the injections at the base.



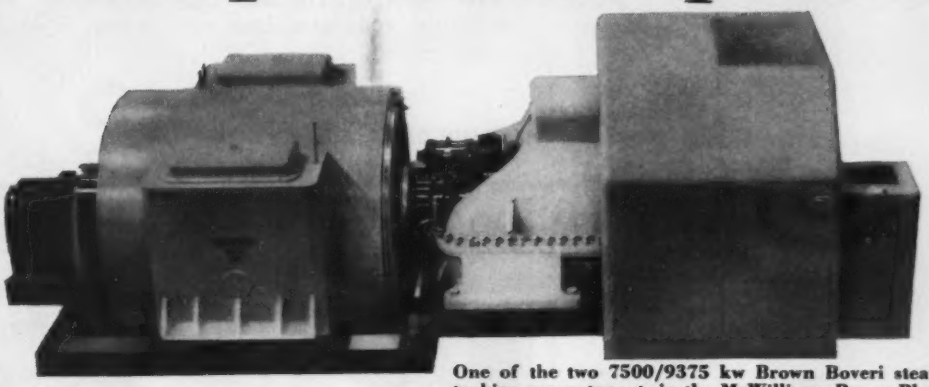
HERBICIDE SOLUTION is injected into ground at base of woody plants

The soil injection method proved effective in control of post and blackjack oak, elm, honey locust, and gum elastic. Tests were made with solutions of 4 to 8 lb of 2,4,5-T in 100 gal of diesel oil. Experiments were also made with 6 to 8 lb of Karmex W or Karmex FW per 100 gal water. Oil carrier proved more effective than water in applications of 2,4,5-T.

Treatments were applied with good results, beginning with the buildup of soil moisure in early spring and continuing until the moisture was depleted and soil tem-

(Continued on page 122)

true economy STARTS with the purchase price



One of the two 7500/9375 kw Brown Boveri steam turbine generator sets in the McWilliams Power Plant of Alabama Electric Cooperative, Inc. at Gantt, Ala.

BROWN BOVERI TURBO-GENERATORS

BUT the purchase price is, by no means, the end of the *True Economy* of a Brown Boveri Turbo-Generator. The moment it goes into operation, it starts its long life and will begin to demonstrate its TOP EFFICIENCY, THOROUGH DEPENDABILITY, WORLD-FAMOUS QUALITY and LOW MAINTENANCE . . . all made possible by the advanced engineering design . . . produced from the best of materials by the Skills of Craftsmen, the products of Brown Boveri's specialized apprenticeship program and stimulated by the traditional Brown Boveri pride of accomplishment in carrying out their assignments.

That's why you can *expect* MORE . . . and *get* FAR MORE . . . from a Brown Boveri Turbo-Generator.

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BROWN BOVERI CORPORATION

19 RECTOR STREET NEW YORK 6, N. Y.

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*Versatility

*Is the middle name of the Neale Model "K" pull type spinner . . .

- Spins new and existing cable
- Has instant adjustment from minimum to maximum cable sizes
- Spins one or two spirals
- Lashes one, two or three cables at one time
- Uses all sizes and types spinning wire
- Weighs only 36 pounds

THE MODEL "K" IS TRULY A VERSATILE CABLE SPINNING MACHINE

PLEASE WRITE FOR LITERATURE

CABLE SPINNING EQUIPMENT CO.

3100 TOPEKA AVE.
TOPEKA KANSAS
Phone 2-7234

Kills Plants Cheaply

(*Continued from page* 120)

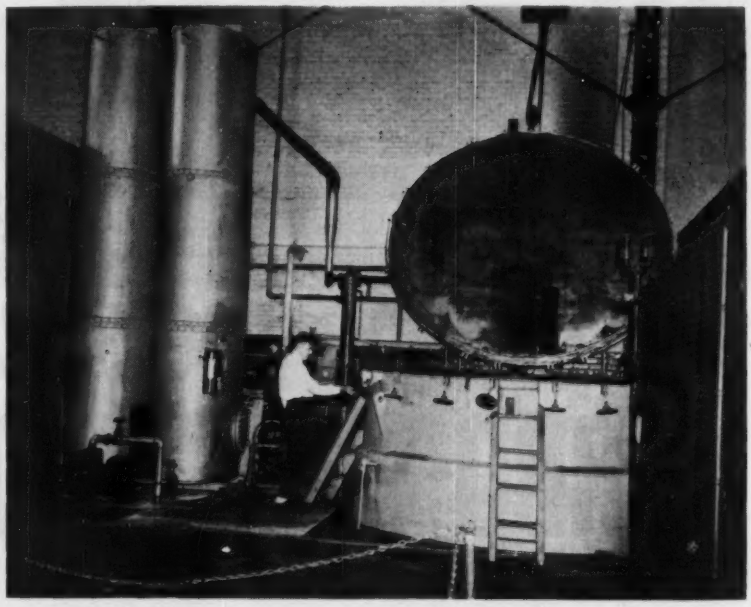
peratures relatively high. This usually occurs in early June at College Station, Texas.

Perhaps the greatest advantage of soil injection as a method of individual plant treatment is the failure of treated plants to develop basal sprouts. Treated plants die progressively from the top. A tree killed as far as ground level dies without sprouting. The soil injection method produced a higher percent kill of post and blackjack oak than obtained from spraying the trunk base.

Greatest disadavantage of the soil injection method is the difficulty of locating exactly underground plant parts for proper placement of the solution. Some plants seem to be more easily killed than others by this method. Plants also show a definite seasonal response to soil injection.

Advantages of the soil injection method of killing plants appear greatly to offset disadvantages.

DISTRIBUTION—Maintenance



VACUUM OVEN is an elliptical tank, 8 by 10 ft across and 12 ft high. It has an outer steam jacket and hinged cover, both covered with 2 in. of insulation

Dries Transformers Faster

A. W. SHELHORSE, Supervisor, General Repair Shop, Georgia Power Co, Atlanta, Ga.

A vacuum oven cuts time for drying power transformer cores to less than ⅓ of that required by the old atmospheric-pressure oven in Georgia Power Co's general repair shop.

The vacuum oven, constructed of ½-in. steel plate, is an elliptical tank measuring 8 by 10 ft across the top and 12 ft high. It has an outer steam jacket and hinged cover, both covered with 2 in. of insulation, and a 51 hp, 100-cfm rotor-type vacuum pump.

Preheated at 90C

In the oven, cores are preheated at 90C using 15-psi steam and admitted to the jacket through a solenoid valve controlled by a thermostat. Cores are usually heated for

(*Continued on page* 125)

"I'll never replace VICTOR SUSPENSIONS... I just won't live that long!"

Men who purchase insulators are enthusiastic about the service records of VICTOR Suspensions. That's because VICTOR Suspensions are laboratory designed, manufactured under rigid quality controls and tested with the industry's most modern equipment.

Take the No. 900 Insulator shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt are thick, husky and galvanized to withstand severe service. Scientifically fitted glaze gives added strength and added protection against contamination.

Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. When you buy VICTOR, you just can't buy better suspensions!

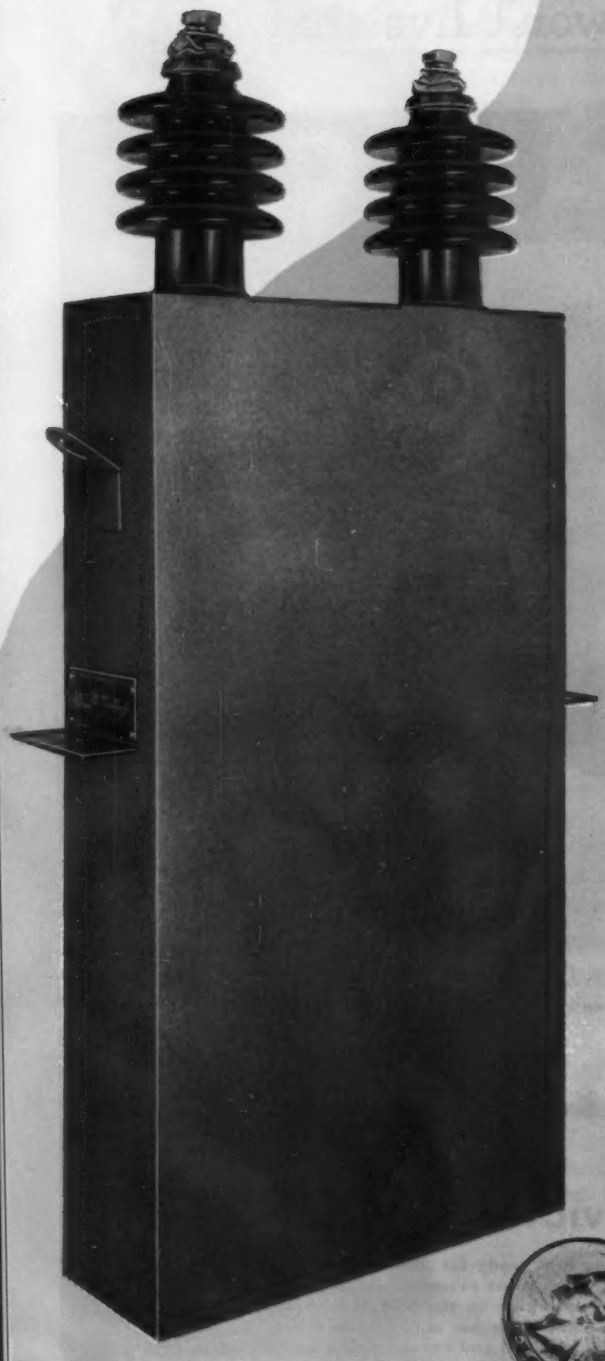
New . . . . . .

VICTOR CATALOG

Now ready for distribution is Victor's newest and most extensive catalog. One of the most complete in the field, it includes illustrations and data on many items being produced at VICTOR and not previously shown, up-to-date EEI-NEMA Standards, and an outline of VICTOR'S new plant, research, testing and manufacturing facilities. It's FREE! Write for *your* copy.

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC.
VICTOR, N. Y.

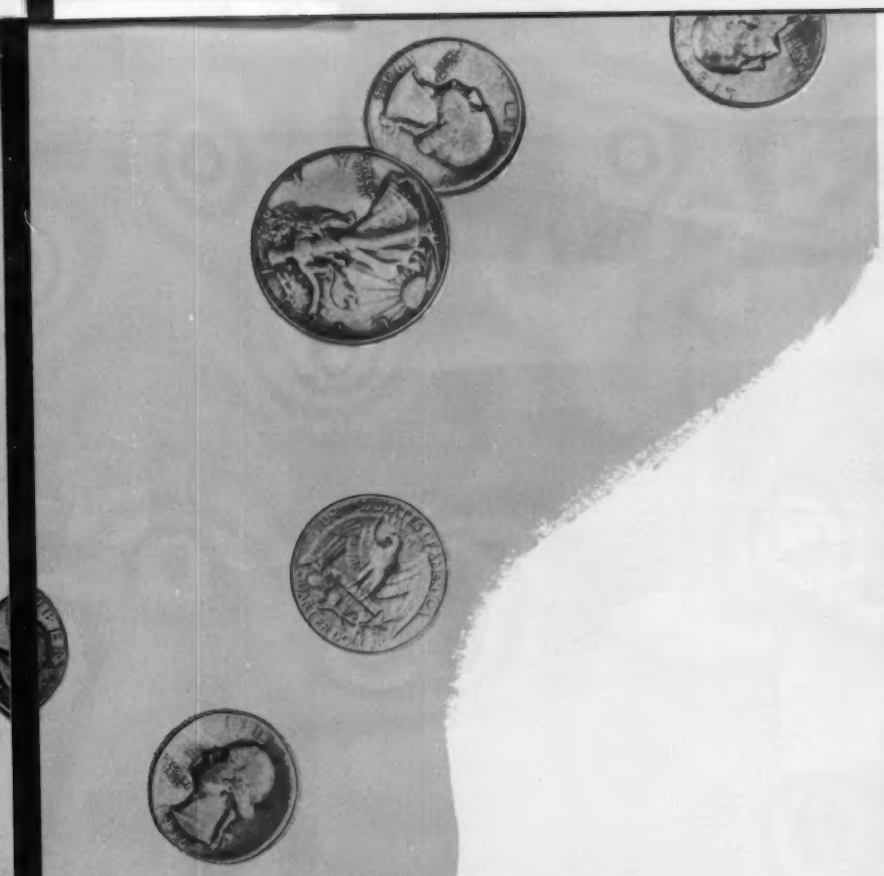


More capacitor for your dollar...

THERE IS LITTLE IN THIS WORLD YOU CAN'T GET "A LITTLE CHEAPER." In capacitors the cost of "a little cheaper" can be disastrously high—in maintenance and replacement. That's why C-D capacitors are built to stand up and last . . . have proven records of field performance extending over 20 years.

When you install C-D capacitors your savings are real and long range—because C-D builds into every capacitor longer trouble-free life. C-D capacitors can take the extra surge, the unexpected overload—because C-D capacitors have the "built-in extras"—because they're "Best by Field Test."

Insure low-maintenance service from your next power-factor capacitor installation, by talking it over first with a C-D engineer. Just write Cornell-Dubilier Electric Corporation, Dept. D-67, South Plainfield, New Jersey.



Here's why C-D Capacitors consistently exceed all field performance requirements:

• Lowest dielectric unit stress and highest major insulation level. • Dykanol-filled bushings increase accepted flashover safety-factor, insure high level of impulse withstand. • Removable solderless connectors. • Many sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor. • Discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution. • Side mounted lifting lugs—stronger and avoid risk of flashover. • Energization tested, 100 percent, to assure uniform distribution of low dielectric losses.

CORNELL-DUBILIER

consistently dependable

power-factor capacitors

SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER & CAMBRIDGE, MASS.; PROVIDENCE & HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD, FUQUAY SPRINGS & VARINA, N. C.; VENICE, CALIF.; & SUB.: THE RADIART CORP., CLEVELAND, OHIO; CORNELL-DUBILIER ELECTRIC INTERNATIONAL, N. Y.

Dries Faster

(*Continued from page* 122)

60 hrs to obtain an uniform temperature throughout. Then, in addition to the heat, the pump is run for 24 hrs to pull a vacuum of 28-in. Hg. This 84-hr cycle completely dries the average core, which is then sealed by oil immersion before the vacuum is broken.

Exhaust gases from the oven pass through a water-cooled tube-type condenser before reaching the pump to reduce contamination of vacuum-pump oil. For the same reason, the oil is circulated continuously through a settling tank and filter press during pumping.

The oven cover is opened and closed by a motor-driven winch with push-button controls. Screw clamps, operated by hand wheels, compress the cover gasket and start the vacuum seal. To facilitate operating the clamps, the oven was placed in a 7-ft pit, so that the hand wheels are about 5 ft above the floor.

Cores are lowered into the oven and removed by the overhead bridge-type crane.

GENERATION—Construction

Low-Slung Cart Eases Plate, Pipe Handling

A low-slung, materials-handling cart was designed and built by the crew of the White River Station of Indianapolis Power & Light Co for handling plate, pipe, and round bar stock for maintenance purposes. Handling these materials formerly required two or more men.

One man, using the cart, can move these materials safely and easily to almost any place within the plant.

The cart has 12-in. dia wheels, a low center of gravity, and beveled ends which permit easier loading and unloading of steel sheet and plate.

Reads Microfilmed Cards

The National Bureau of Standards has completed FOSDIG II, a high-speed electronic device for reading microfilmed copies of punched cards and for searching for cards containing specific information.

RCA Whirlpool MIRACLE

PROMOTE THE ELECTRICAL WAY

To help promote the idea of living better electrically, the Whirlpool Corporation has sent two of its Miracle Kitchens on tour of the U.S.A. Millions of people will see this amazing display, and will be made more aware of the many benefits of living in an all electric home.

Out of the same great laboratories where researchers and engineers look far into the future and create ideas such as the Miracle Kitchen, comes the full line of RCA WHIRLPOOL electrical appliances of today.

All of these appliances are the key to the present and future expansion of utility revenue. They are building a balanced load for electric utilities to provide tomorrow's electrical way of life.

Creating opportunities for increased

Use of trademarks RCA and RCA authorized by trademark owner Radio Corporation of America

KITCHENS OF LIFE!

Your local RCA WHIRLPOOL Distributor or any one of our regional utility managers has full information on many successful electrical promotions. These people are ready to work with you and to serve you at any time. Write, phone or call your local RCA WHIRLPOOL Distributor for the complete story.

utility revenue!

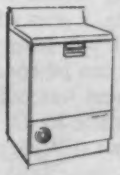
ELECTRIC WASHER

ELECTRIC WASHER-DRYER COMBINATION

ELECTRIC DRYERS

ELECTRIC REFRIGERATORS

ELECTRIC RANGES

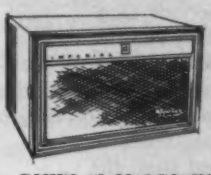

ELECTRIC DISHWASHERS

ELECTRIC FOOD WASTE DISPOSERS

ELECTRIC FREEZERS

ELECTRONIC OVEN

ELECTRIC ICE CUBE MAKER


ELECTRIC AIR CONDITIONERS

ELECTRIC DEHUMIDIFIER

RCA WHIRLPOOL Home Appliances
Products of
WHIRLPOOL CORPORATION
St. Joseph, Michigan

Team Up Control of Water and Space Heating

- Cut system peak, using staggered voltage restoration to regulate both
- Simplify control with only one clock, one period

VIRGIL R. BERRY, President, Radiant Glass Distributors, Inc, Springfield, Ill.

For systems that purchase electricity wholesale, paying on the basis of power demand plus energy requirement, minimum system peak is essential. Most REA cooperative systems are in this category. When such a system contemplates supplying service for electric house heating, it goes without saying that service will have to be controlled. That it can be controlled without impairment was outlined previously in an article by D. S. Welch and the author (EW, Sept. 5, 1955, p 88).

One Control Suggests Another

Control of space heating load suggests that water heating service be examined to see whether control of it will add to or subtract from the peak caused by house heating.

To determine this, a study of water heating service was made from April 4th to May 30th, 1955, on the systems of Adams Electric Cooperative, the Illinois Rural Electric Co, and Corn Belt Electric Cooperative, all in Illinois. Strip-chart wattmeters were placed in 26 homes and records taken for two weeks of uncontrolled and two weeks of controlled water heater service. Control consisted of three daily cutouts, from 7 to 9 am, 11 am to 12:30 pm, and 5 to 10:30 pm. At the time of the study, Adams Substation system had 343 water heating customers.

Figure 1 is reproduced from the controlled space heating study which was the basis of the Electrical World article previously mentioned. It shows three ways of control, and indicates that 30-min staggering of voltage reduction and restoration result in the most favorable peak condition. Thus, the data of the solid line on the chart are those used here.

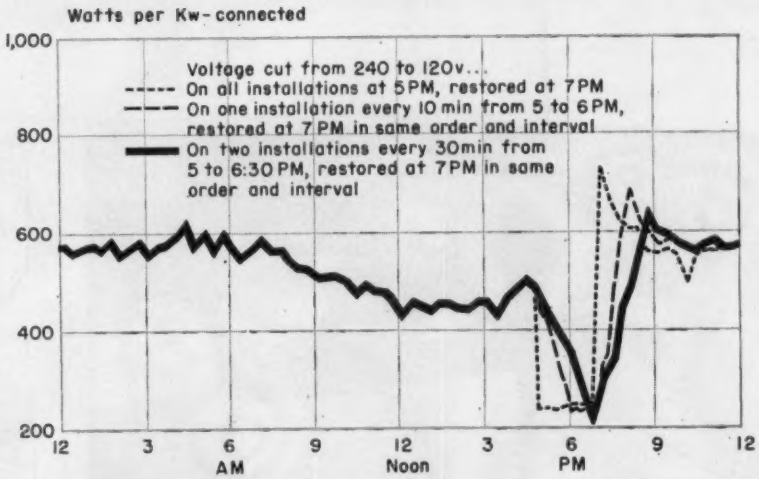

Watts per Kw-connected
1,000
800
600
400
200
Voltage cut from 240 to 120v...
On all installations at 5PM, restored at 7PM
On one installation every 10 min from 5 to 6PM, restored at 7PM in same order and interval
On two installations every 30min from 5 to 6:30 PM, restored at 7PM in same order and interval
12 3 6 9 12 3 6 9 12
AM
Noon
PM

FIG 1—SPACE HEATING CONTROL is shown in three ways. Solid line indicates best method of control, 30-min staggering of voltage restoration

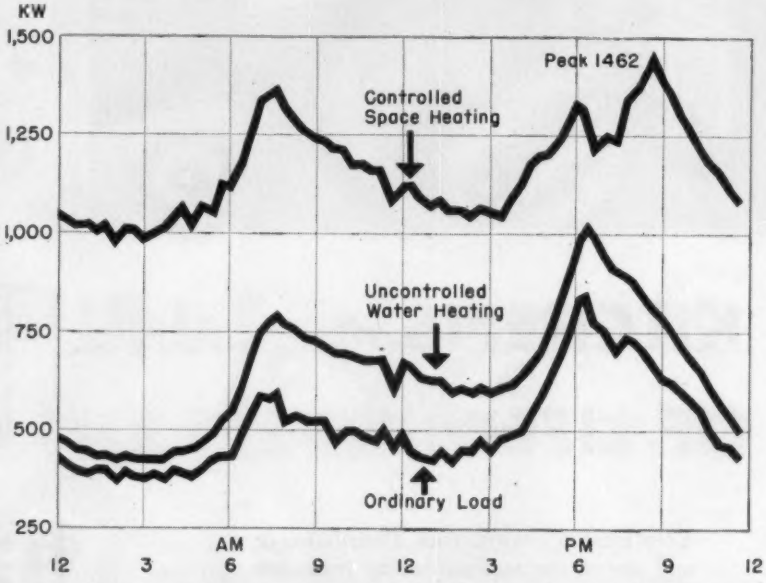


FIG 2—HEATING LOAD WITH UNCONTROLLED WATER HEATING shows apparently favorable peak of 1,462 kw. However, staggered control may reduce this

Data allowed two syntheses of system load to be made. Each assumes a heating load of 1,000 kw (10% of the cooperative's members), with one showing uncontrolled and the other controlled water heating. Figure 2 and figure 3 (p 131), respectively show the curves of the expanded data.

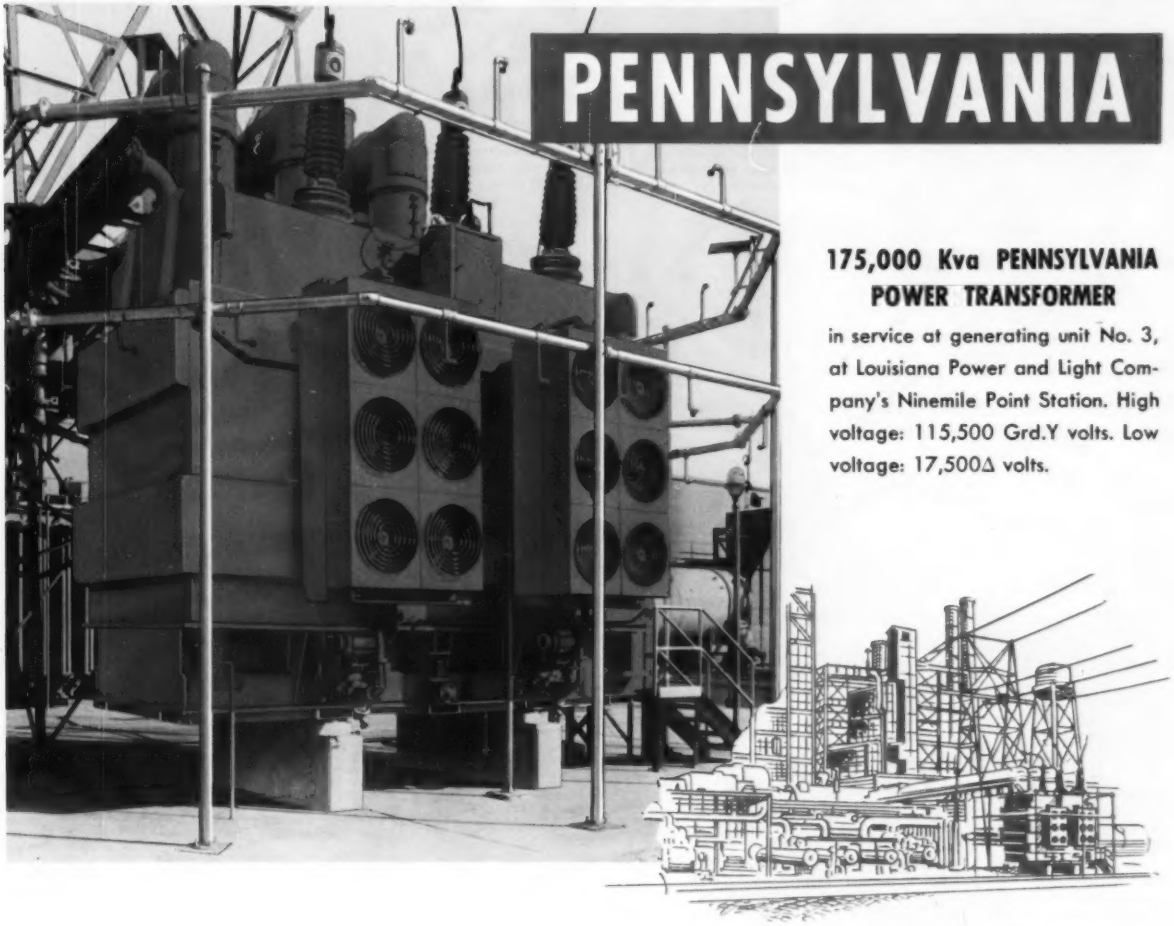
At first, figure 2 for uncontrolled water heating appears more favorable with a peak demand of 1462 kw as against 1512 kw for the controlled service shown in figure 3. However, this higher peak might be reduced, as indicated by the

(*Continued on page* 131)

For the BIGGEST transformer job of all at Ninemile Point . .

Louisiana Power & Light chose

PENNSYLVANIA



175,000 Kva PENNSYLVANIA POWER TRANSFORMER

in service at generating unit No. 3, at Louisiana Power and Light Company's Ninemile Point Station. High voltage: 115,500 Grd.Y volts. Low voltage: 17,500Δ volts.

Turbine-generating unit No. 3 at Louisiana Power and Light Company's Ninemile Point station has a net capability of 135,000 kilowatts. By far the largest unit in what is said to be one of the most fully automatic utility power plants in the country, No. 3 gives Ninemile Point a total generating capacity of 319,000 kilowatts.

For unit No. 3, a 175,000-kva Pennsylvania Power Transformer steps up the generated voltage of 17,500 volts to the transmission voltage of 115,500 volts. Only twenty feet in overall height, this transformer features Pennsylvania's shell form Contour Design, which permits even the highest capacity transformers to be shipped to the installation site in an upright position — completely assembled except for bushings and certain external accessories. As a result, less than four actual working days — with only four men working most of that time — were required to move this 175,000-kva Pennsylvania Transformer into position and ready it for connection to the line.

For installation economies as well as proved performance, it will pay you to check Pennsylvania regarding *your* next power transformer installation.
Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

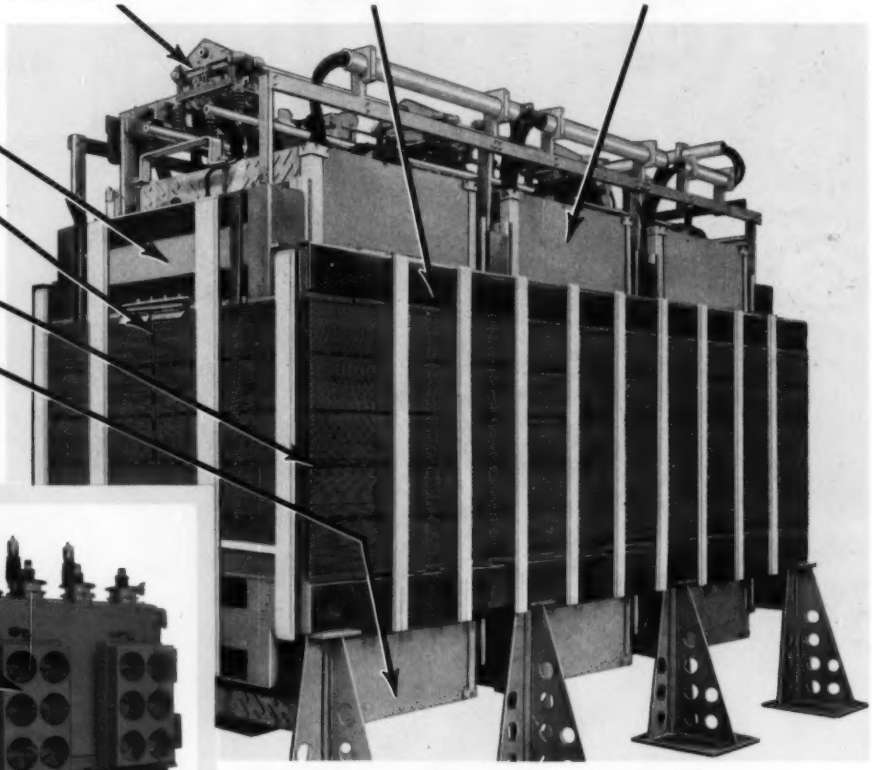
PENNSYLVANIA POWER TRANSFORMERS

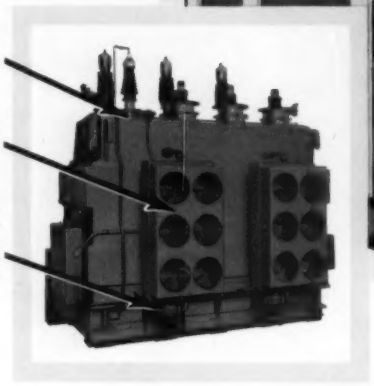
See other side for design details

On unit No. 3 at Louisiana Power & Light's Ninemile Point Station . .

175,000 Kva CONTOUR DESIGN, GENERATING STATION

Pennsylvania Power Transformer


Tap changer is accessible through manholes for inspection and maintenance.
Heavy steel frames clamp core and coils together to form rigid structure.
Core-and-coil unit can be handled separately as a complete sub-assembly.
Heavy box sections form part of core frame and clamp coils against short circuit forces.
Vertical cooling ducts in the coils permit a free flow of oil through the coils.
Core cooled by both vertical and horizontal ducts.
Core-and-coil assembly rests on bottom section of tank.


Overall height of transformer is only 20 feet.
Transformer is cooled by four forced-oil to forced-air heat exchangers.
Pennsylvania's exclusive Seal-Master Pump is self-contained, self-lubricating, and has integral motor-pump shaft.

175,000 Kva, 3 Phase, 60 Cycles, 55°C. Temperature Rise. Forced-oil, forced-air-cooled. High Voltage: 115,500 Grd.Y volts. Low Voltage: 17,500Δ volts.

PENNSYLVANIA HAS THE *FACILITIES* AND THE *CAPABILITY* TO MEET THE LARGEST POWER TRANSFORMER REQUIREMENTS

- A large, expertly-staffed engineering department with long experience in power transformer design—both core form and shell form.
- The ability to design and construct full-scale test models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by the industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.

PENNSYLVANIA TRANSFORMER DIVISION

McGraw-Edison Company

CANONSBURG, PENNSYLVANIA Greater Pittsburgh District

For Installation view, see other side

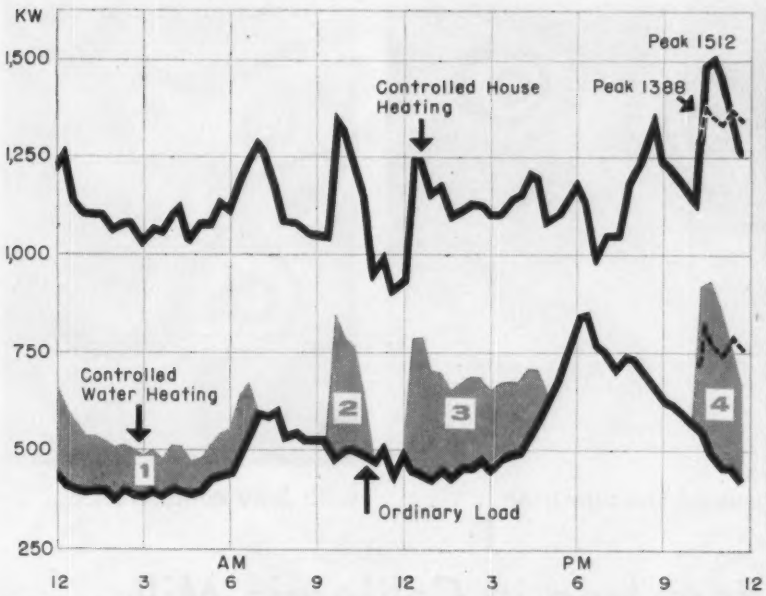


FIG 3—HEATING LOAD WITH CONTROLLED WATER HEATING (shaded areas) shows how peak of 1,512 kw might be reduced (dotted line in area No. 4)

dotted line, by staggering the return of the water heater load after the 5½-hr evening cutout in a manner similar to voltage restoration used in control of the space heating load.

It is apparent from these charts that daytime control of water heating serves no useful purpose. It merely causes two sub-peaks which are of no particular significance. Eliminating these periods simplifies the control task and makes staggering of water heater load recovery in the evening a more reasonable idea. Such a staggering might well be combined with that for space heating; both can be done by one clock.

The water heater load data used represented seven-days-a-week averages. The daily figures indicated no particular day for clothes washing. The Saturday-night bath did show up in a larger energy use early Sunday morning.

So far as consumption is concerned, there seems to be little from which to choose between uncontrolled and controlled water heating. Extending the record data to monthly kwhr use per customer results in 248 for the first and 256 for the second. This difference might easily have been caused by some factor other than control or no control.

A.C. Up at Comm Ed

Commonwealth Edison Co reports air conditioning is going in its area at a record pace. During 1956 there was a 30% increase in air conditioning on the company's lines, the largest single annual jump since 1945. At the end of '56, Commonwealth Ed has 753,000 kw of A.C. Of the 169,500 kw added in 1956, more than half was in central systems in commercial and industrial buildings. Number of room coolers that went in in '56 totalled 57,000, about the same as '55. Grand total of these units now stands at 222,000. Residential central systems number 4,500, about 1,800 of which went on the lines in last year.

A.C. Research Center

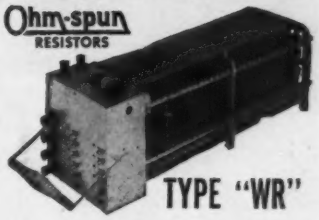
Trane Co has recently finished putting up a $1¼ million design center for its air conditioning and heating products at LaCrosse, Wis. The center complements the company's research and testing lab—"The House of Weather Magic."

(More Selling on page 132)

THE STATES COMPANY

Leaders in Electrical Testing Equipment

Ohm-spun RESISTORS

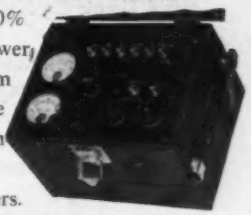


TYPE "WR"

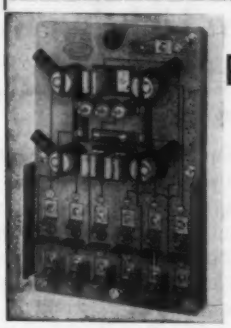
- Non-inductive Resistance.
- Smooth adjustment from .05 amperes to full capacity of the load.
- Loads are made in different capacities; 30 amperes, 25/50 amperes and 60 amperes.
- Light in weight yet ruggedly constructed.
- All units self-ventilated.

TYPE ID LOAD

Provides 50% & 100% Power Factor from single phase supply when testing power meters.



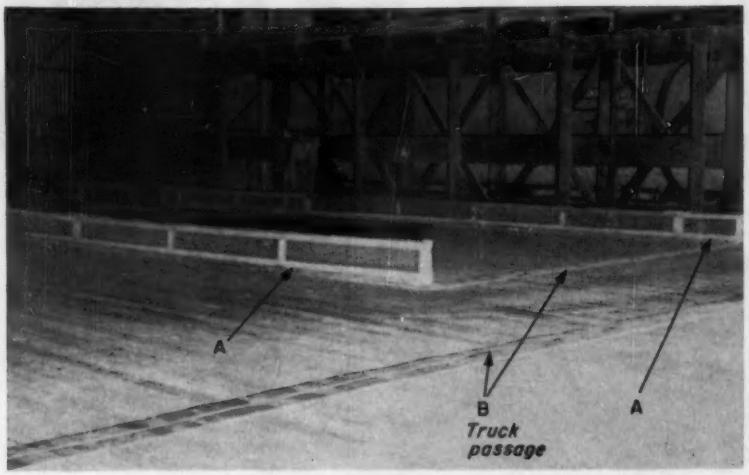
Capacities available: 5-15 and 50 amperes.



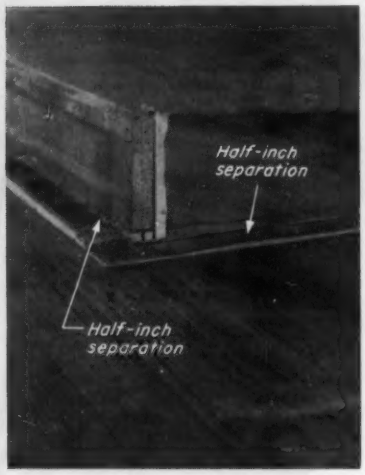
POLYPHASE METER TEST JACK

All connections made to terminals at bottom of the jack. No wires cross face of meter. Internal connections printed on front of jack. Other forms of Jacks now available.

THE STATES COMPANY
19 New Park Avenue, Hartford, Conn.
Please send me more information on:
☐ Resistors ☐ Type ID Loads ☐ Test Jacks
Name .....Title.....
Firm Name.....
City .....Zone....State.....



Eight-inch electrified fence around storage area . . .



with 2-kv conductors . . .

Keeps Rice Rodent-free in California Mill

F. W. WOMBLE, Power Engineer, Pacific Gas & Electric Co, Stockton, Cal.

Small electric fences installed around all grain storage areas have practically eliminated rodent damage at the Pacific International Rice Mills plant in Stockton, Cal. An ordinary electric fence unit supplies 2,000 v at 16 ma. from a 15-v outlet.

One section of the fence (A) consists of a 3-inch wide, fine mesh screen, laid horizontally on the floor and separated by a half-inch gap from an 8-inch high, fine mesh vertical screen. The other section of the fence (B) used in those areas travelled by fork lift trucks, comprises two flat, 2-inch metal strips, laid horizontally on the floor with a half-inch separation between.

The rodent is electrocuted when it attempts to climb the fence or cross the two parallel metal strips.

Modern Lighting Means Increased Production

K. L. HENRY, Industrial Sales Engineer, Connecticut Light & Power Co, Meriden, Conn.

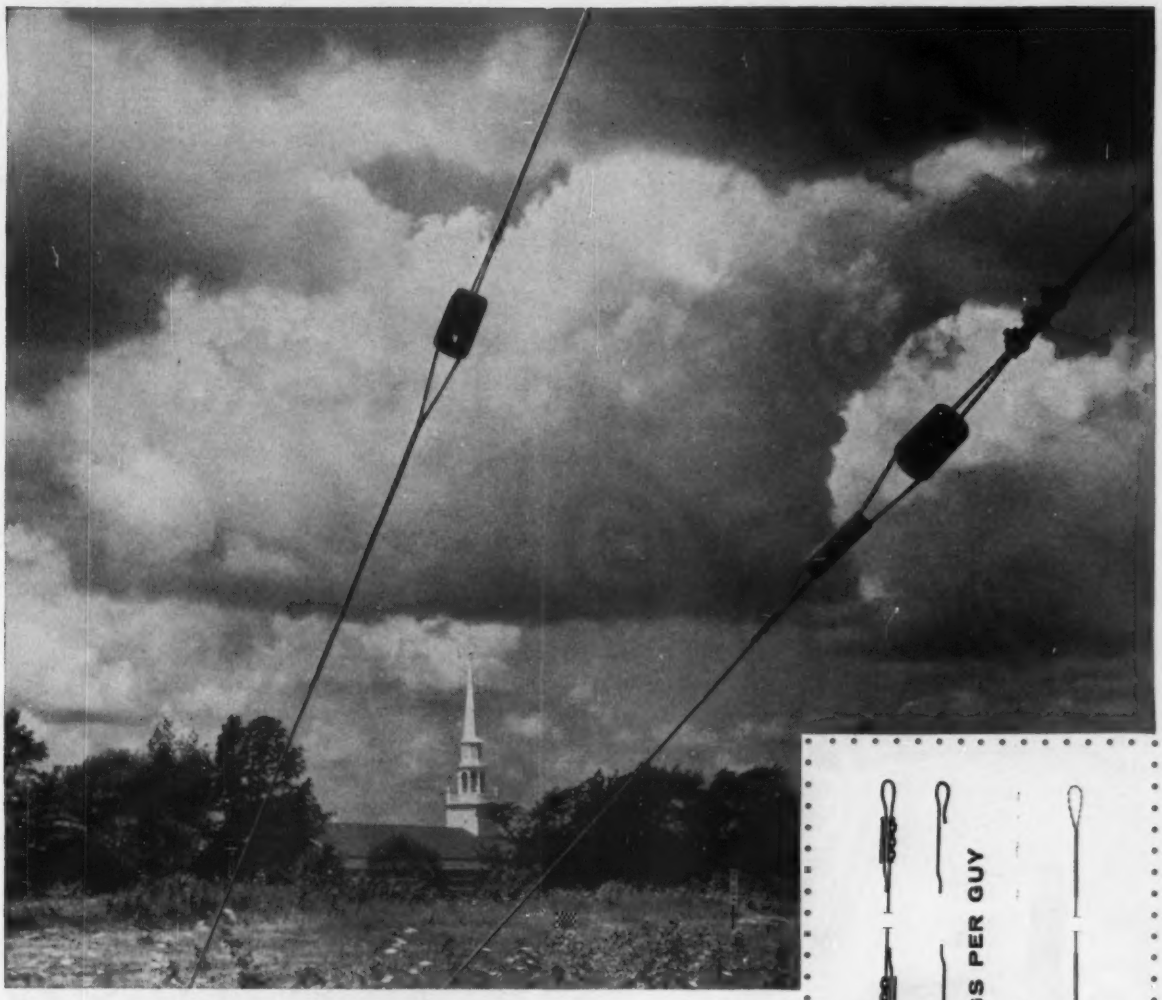
A well-planned fluorescent lighting system that enables employees to work more rapidly and more accurately is one of the vital components in the modern printing plant recently built by the Journal Press, at Meriden, Conn. The system maintains a minimum illumination level of 50 foot-candles, has high efficiency, and is economical.

Before the installation was made, various types of lighting were compared. Fluorescents were selected because they produced more light for the money invested. In addition, they kept wiring sizes, relamping cost, and maintenance to a minimum.

The fixtures are two-lamp, eight-foot, T12 Slimlines, with industrial-type reflectors. Spaced on 12-ft centers, the lamps are mounted 12 feet above the floor. To reduce excessive contrast, the walls of the room were painted with a light green, high reflectance paint, the ceiling with aluminum paint.

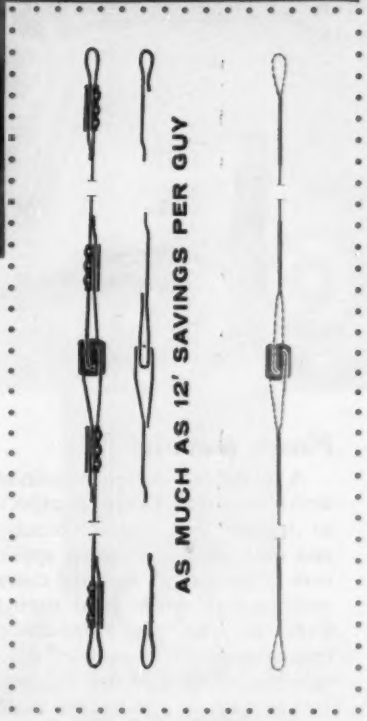
The Journal Press is owned by Connecticut Calendar Co. With 44 years experience in the commercial printing

field, the company realized that to reach peak production and maintain its competitive position, lighting and other plant facilities would have to be completely modern.



Up to 30% savings in strand... with PLP Guy-Grip Dead-Ends

You will find real guying economy with PLP Guy-Grip dead-ends. Because they eliminate strand looping, you can use *shorter, straight* lengths of guy strand. This means as much as 12 feet savings in strand per guy. What's more, the finished installation is neat, streamlined, efficient.



PX-80

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO
DEPT. NO. PR1B
Telephone: Cleveland EXpress 1-3571

NEW EQUIPMENT

Line Truck

This line construction truck is designed for city operation. Identified as the 3022, it has a heated crew compartment and extra space for tools, tackle, and supplies. Both winch and pole derrick are provided, one driven by the main 5-speed transmission, the other taking power from an auxiliary transmission. Short over-all length, wide-tread front axle, and short turning radius reportedly assure good maneuverability. Cab tilts forward, for easy access to radiator, motor, clutch and transmission.

White Motor Co, Cleveland 1, Ohio

Compression Connectors

These compression connectors may be used to splice both aluminum and copper conductors without electrolytic action, according to the manufacturer. They are made of aluminum with hot-tin coating.

Line consists of one- and two-hole lugs and two-hole connectors from No. 8 AWG to 1,000 Mcm. Sizes from No. 8 to 3/0 are color-keyed to a die in the TBM-5 hand tool shown. Sizes No. 4/0 to 1,000 Mcm are color-keyed to hex dies in a hydraulic tool. Color-keying reportedly makes installation faster and surer, simplifies joint inspection. Compression tooling assures high pull-out value, low resistance.

Thomas & Betts Co, 36 Butler St, Elizabeth, N. J.

Plastic Material

A plastic polycarbonate resin material, known as Lexan, is expected to replace cast metals, ceramics, and other plastics in some applications. Some of its reported characteristics are: tensile yield strength, 8,000 to 9,000 psi; water absorption after 24-hr immersion, 0.3%; specific gravity, 1.20; arc resistance, 100 to 140 sec.; short-time dielectric strength, 0.125-in. thickness, 400 vpm; 60-cps dielectric constant, 2.80; 60-cps power factor, 0.009; melting point, 514 F; flammability, self-extinguishing. It is being evaluated in a variety of forms.

General Electric Co, Chemical & Metallurgical Div, Pittsfield, Mass.

Truck

The body on this truck can be raised to a maximum height of 52 in. or dropped until it rests on the ground. Cargo may be loaded directly from curb, into rear or side of truck without lifting.

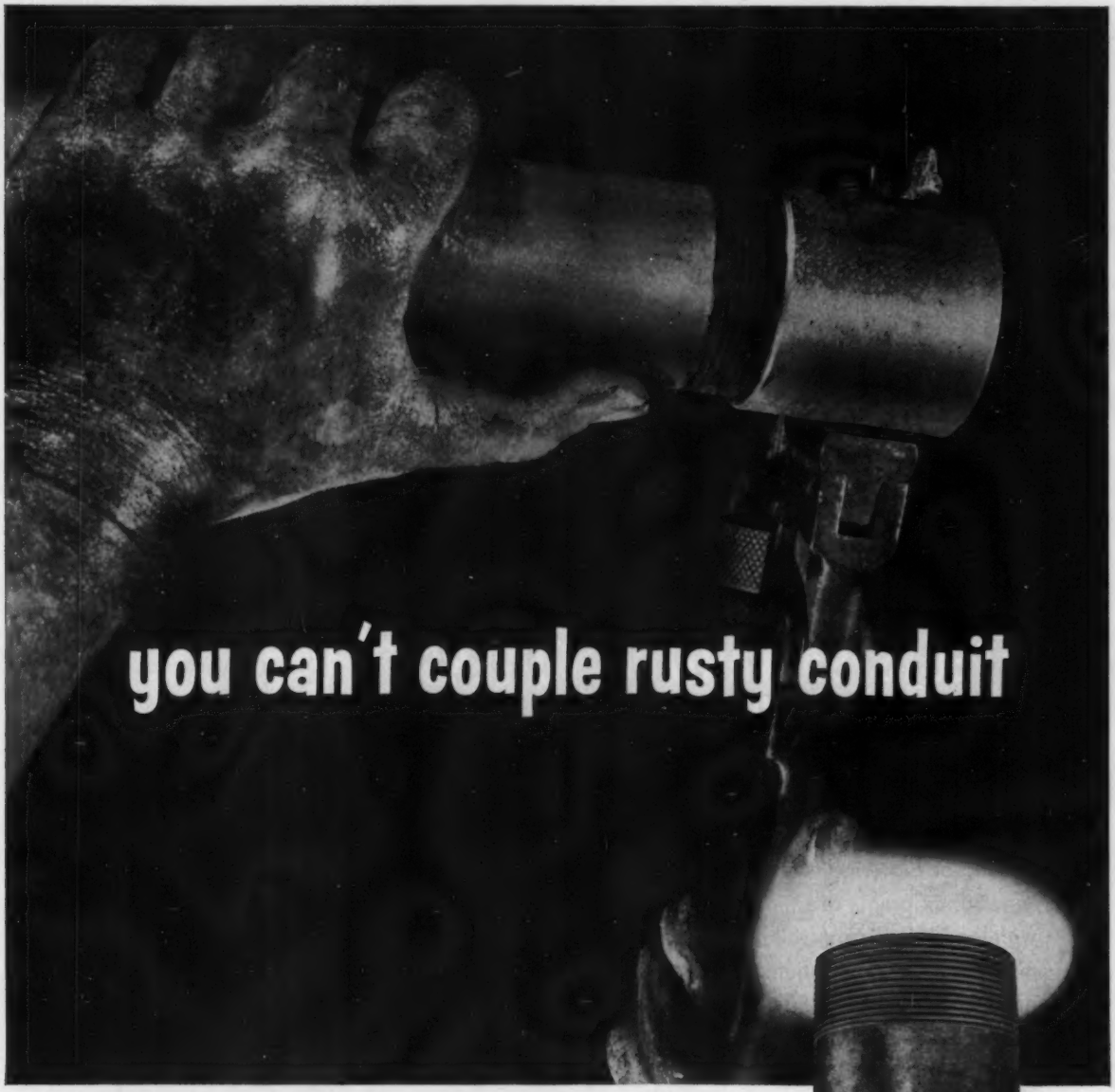
With van, stake, or platform bodies, the truck is available in two models: TTL-5 has 5-ton payload, 12-, 14-, or 16-ft body length, and 1,500 to 2,000-psi hydraulic system; TTL-10 has 10-ton payload, 12-, 14-, 16-, 18-, or 20-ft body length, and 2,500-psi hydraulic system.

Thompson Trailer Corp, P. O. Box 356, Pikesville, Md.

Snatch Block

These stringing snatch blocks feature a widened throat design which reportedly simplifies reconductoring, allowing new conductor

(Continued on page 136)



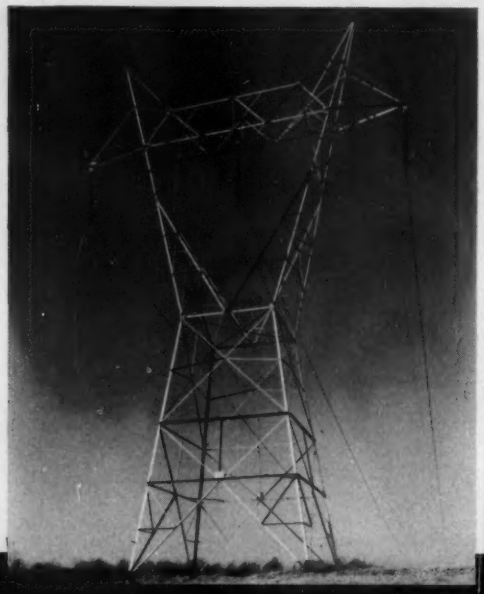
THAT'S WHY PITTSBURGH STANDARD'S HOT-DIP GALVANIZED THREADS SAVE YOU MONEY

The cost of labor must be figured into the original cost of conduit if you have to pay workmen to chase conduit threads which have rusted in your storage. That's why Pittsburgh Standard's Hot-Dip Galvanized Conduit with *hot-dip galvanized threads* is the least expensive conduit . . . threads just can't get rusty. This happy result is made possible by the world's most modern conduit mill, Pittsburgh Standard's Morrisville plant. The process developed at Morrisville has now been extended to cover Etna production on all sizes through 6 inches. You can get shipping and price information by writing or calling your nearest Pittsburgh Standard wholesaler or *Pittsburgh Standard Conduit Co., 61 Bridge Street, Pittsburgh 23, Pa.*

PITTSBURGH STANDARD CONDUIT CO.

PLANTS AT MORRISVILLE & ETNA, PA.

RIGID STEEL CONDUIT • ELECTRICAL METALLIC TUBING • ELBOWS • COUPLINGS • FITTINGS



ONE COAT OF SUBOX PROTECTS GALVANIZED TOWERS FOR 5 TO 8 YEARS

Indeed, a coat of Subox paint often lasts more than eight years . . . and usually without any chipping, cracking, peeling or blistering.

Subox paints are the only American paints made with lead-suboxide. A colloidal pigment, it assures maximum surface penetration . . . packs to form a dense, impervious coating. Furthermore, being *chemically active*, lead-suboxide *actually works* to strengthen and reinforce the film.

Subox paints have been proved under the severest conditions and are used more widely than any other paints for the protection of galvanized towers. Available in attractive modern colors.

Write for brochure: "Corrosion Control of Electrical Structures and Equipment."

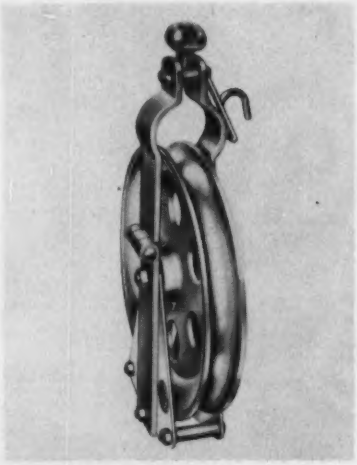
SUBOX PAINTS

Subox Inc.
*Trade Mark

Established 1924
3 Fairmount Plant
Hackensack, N. J.

Snatch Block

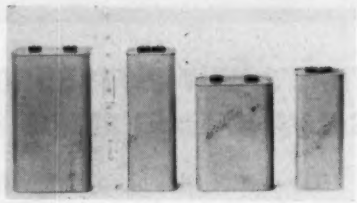
(Continued from page 134)



to be pulled through as old conductor is removed. Throat permits passage of connectors, compression joints, swivels, and splices.

Known as the Series No. 73, they are available in five sizes, from 7x1.375 in. to 16x2.125 in., for conductors ranging from 0.783 to 1.246 in. diam. Series includes safety locking feature which must be turned 90 deg to open. Variety of steel fittings are offered. Other reported features are full length strap and three-point reinforced side plates to guard against damage in moving and handling.

Sherman & Reilly, Inc, 110 W First St, Chattanooga, Tenn.



Capacitors

An expanded line of rectangular base, Pyranol capacitors for single-phase, central air conditioning equipment reportedly have a minimum increase in height and no increase in base dimensions. With bases measuring 4.57 x 2.84 in. and heights to 8 in., the line includes 440-v units rated 30, 35, and 40 microfarads. With 2.25 x 2.93-in.

(Continued on page 138)

A NEW NAME IN BITUMINIZED FIBER CONDUIT

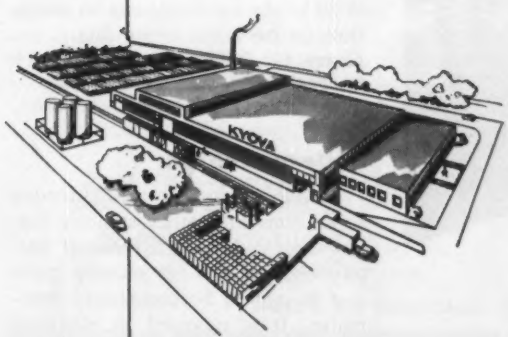
BACKED BY
MORE THAN 100 YEARS
aggregate "key man" experience
serving the electric utility industry.

William D. Kyle, Jr., President

"Renewing contacts that span two generations affords me a happy and challenging prospect. Your satisfaction with our products is my major concern. Please feel free to call on me anytime I can be of service. In spite of years of experience, Kyova is a youthful organization . . . a group of men dedicated to product perfection, service and integrity.

John M. Dollenmaier, Vice President

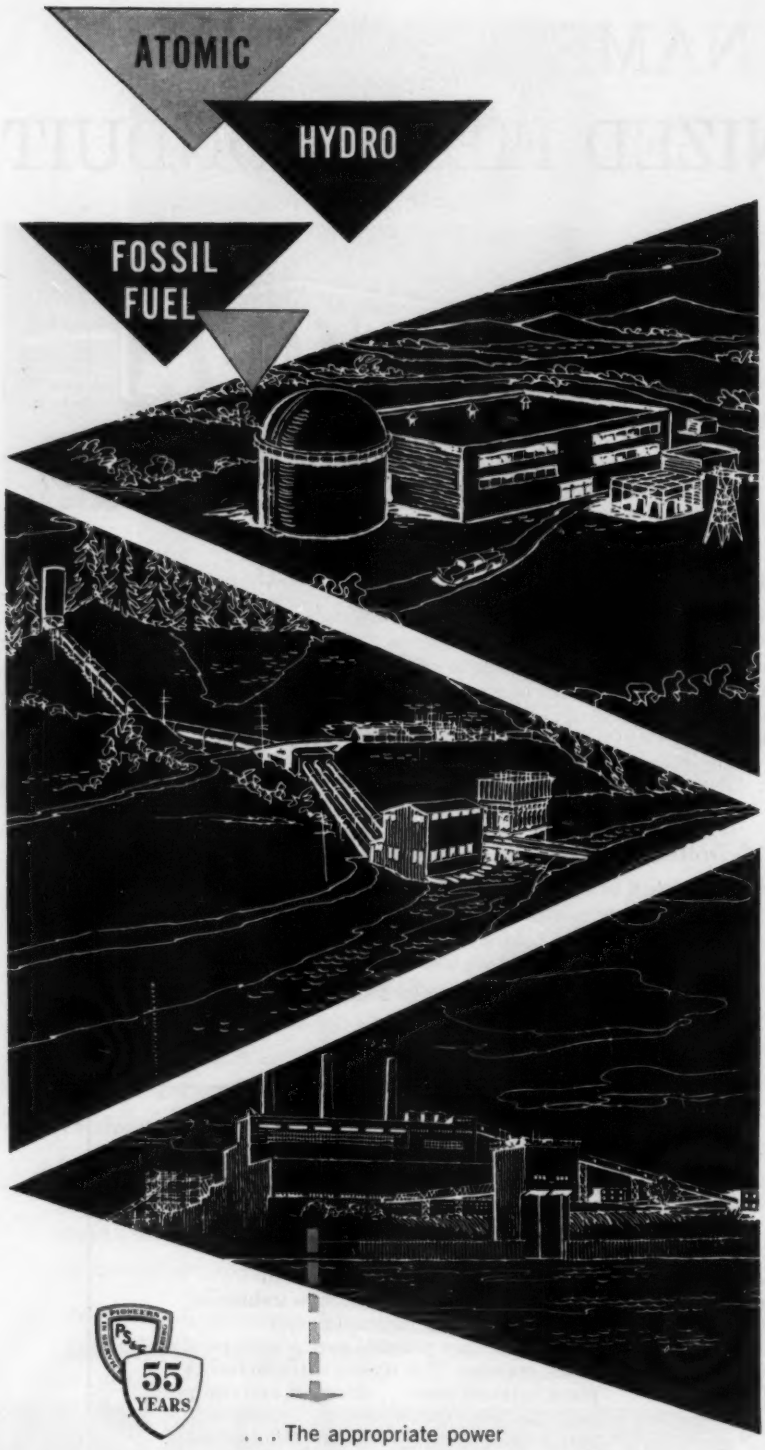
"I'm looking forward to meeting many friends in the utility industry again. I am personally very enthusiastic about our fiber conduit and the organization behind this fine product. Kyova is staffed with engineers and production people who understand your requirements . . . recognized technicians who played important parts in the development of our industry."



Kyova Fiber Pipe Company is located in Ironton, Ohio. Why? For sound economic reasons that are important to you: First, we're adjacent to adequate sources of our major raw materials; Second, the Ironton community provides us with a dependable labor supply skilled in the chemical and paper process industries; Third, our central location makes prompt delivery possible over a large portion of the country. The Kyova manufacturing plant is brand new . . . designed and equipped with the latest manufacturing processes and techniques solely for the manufacture of Kyova Fiber Pipe products. Laboratory apparatus, manned by skilled technicians, constantly assure that the finished product is of a quality conforming to or exceeding all national standards and requirements.

KYOVA

Write for complete information and catalog.
FIBER PIPE COMPANY • IRONTON, OHIO



55 YEARS

. . . The appropriate power for your expanding program

Send for our descriptive booklet, "Pioneering New Horizons" of these and other services.

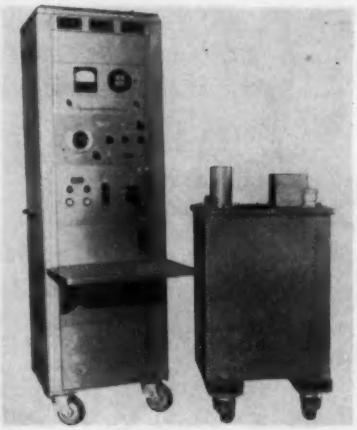
Pioneer Service & Engineering Co.
231 South La Salle Street • Chicago, Illinois

Capacitors

(*Continued from page* 136)

bases and heights to 8 in., units rated 20 microfarads at 440 v, and 30 and 35 microfarads at 270 v are available.

General Electric Co, Schenectady 5, N. Y.



Corona Tester

Intended for non-destructive insulation tests in transformers, cables, capacitors, and other electrical equipment, this Model 2 corona tester permits grounding of one terminal of the component under test and has a maximum power output of 20 kva at 20 kv, 60 cps.

Corona is displayed as individual pulses on an oscilloscope screen. Horizontal sweep is synchronized with test voltage. Specimens with terminal capacitance up to 15 microfarads and impedance to ground of 20 kilohms or more can be tested. Bulletin 66-9 has more data.

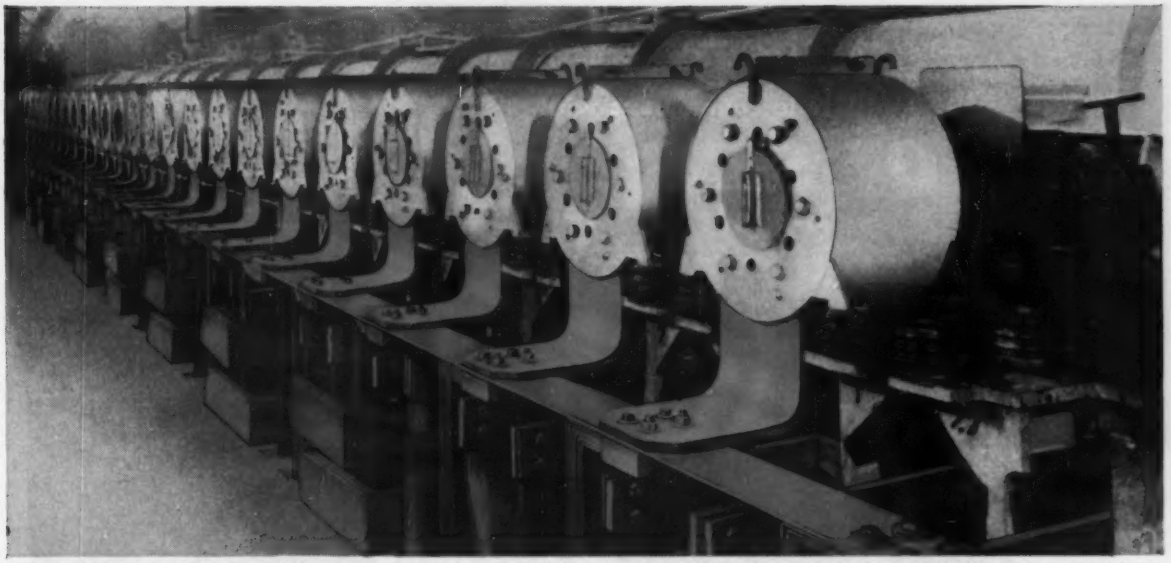
James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

Battery Charger

Developed for use at unattended substations and other standby battery applications, this 60-cell battery charger has no moving parts and is said to be completely automatic. It is reported to eliminate gassing and water loss. High gain magnetic amplifier reportedly regulates output to within ± 1%.

Manufacturer claims selenium

(*Continued on page* 140)



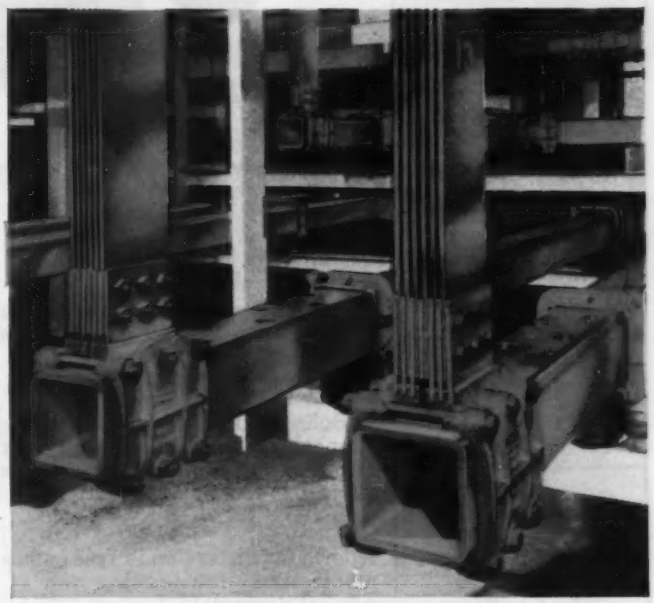
THROUGH THE TINNING LINE, steel sheet up to 38" wide and .0125" gage passes at 1000 feet per minute. A total plating current of about 178,000 amps is carried to the 27 collector heads from the bus room below by these rectangular bus conductors. Installation involves about 115,000 lb. of copper bus conductors.

Big new sheet tinning line drawing 178,000 amperes is served by this compact Copper Bus installation

Copper bus conductors were selected for this installation in a plant of one of America's great steel companies because it made possible a saving of 20 per cent in space.

D. Anderson Murphy, president of Riggs Distler & Co., mechanical and electrical contractors, Baltimore, Md., which made the installation, states that one of the big reasons for the selection of Anaconda bus was the outstanding engineering and technical service available through The American Brass Company. Anaconda engineers worked closely with Riggs Distler to help solve many of the problems posed by this complex job. Mr. Murphy adds that the bus conductors came through well packaged, with clean ends indicating a good sawing job, and came through promptly on schedule—other factors in the selection of Anaconda conductors.

TECHNICAL SERVICES. Anaconda specialists are available to help solve technical problems involving the use of Anaconda Bus Conductors. For such assistance or a copy of the 62-page Publication C-25, "Anaconda Copper for Electrical Conductors," write: The American Brass Company, Waterbury 20, Conn.



A VIEW IN THE BUS CONDUCTOR ROOM, showing ventilated square tubes and flat bars. Sizes of tubes used were 6" and 4" square by ½" and 5/16" by up to 22' 1" long. Rectangular busses used 6" and 4" x ¼" in lengths up to 20'.

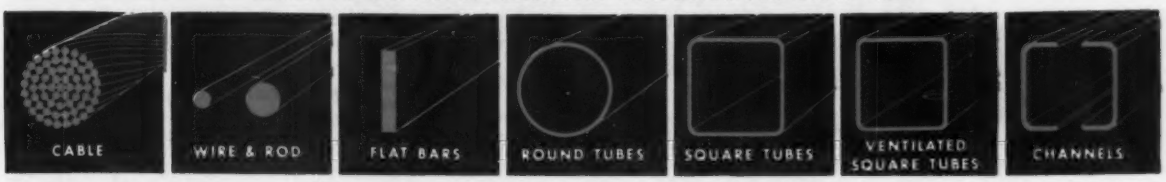
871102

ANACONDA®

COPPER CONDUCTORS

Made by the American Brass Company

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



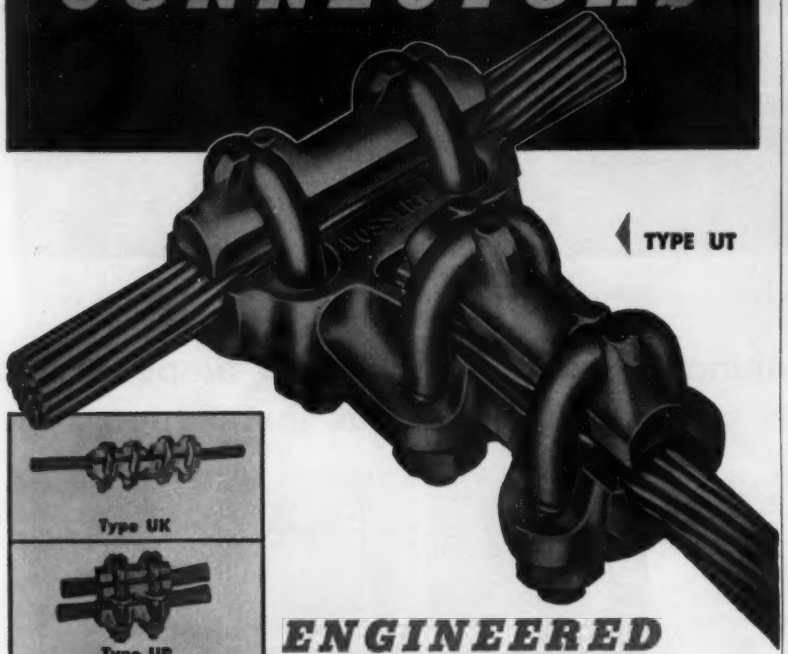
Fast to make fast!

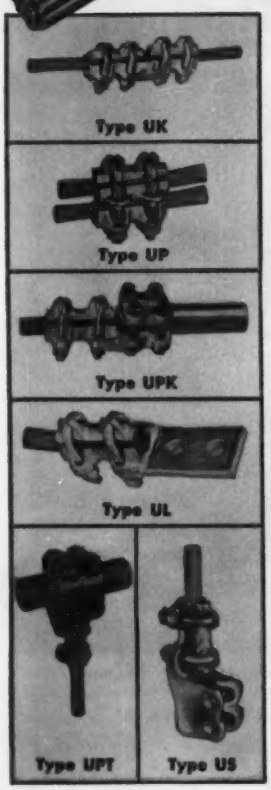
Safe, swift cable connections with

DOSSERT

U-BOLT

CONNECTORS





ENGINEERED FEATURES:

VARIABILITY

Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

HIGH CLAMPING ACTION

U-Bolts clear all conductors by close limits, supported by saddles through their full arcs. Minimizes bending action, makes U-Bolts subject to tensile stress only.

CABLE END RELIEF

Allows for distortion in free ends of strands, ample room for binding end of stranded cable if desired.

CONDUCTIVITY

High copper alloy with sufficient contact area to insure cooler-than-conductor operation under maximum load.

Available for aluminum or aluminum to copper conductors.

Excl. Canadian Distributor: W. S. Gerrie & Assoc. Ltd.
66 Racine Road, Rexdale, Ontario

50 YEARS OF TECHNICAL KNOW-HOW

WRITE FOR DETAILS AND PRICES TODAY!

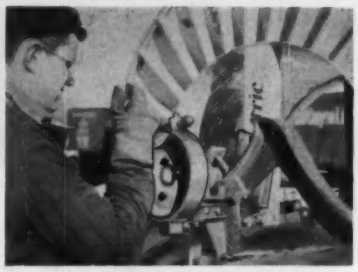
DOSSERT MFG. CORP.

249 Huron Street, Brooklyn 22, N. Y.

Battery Changer

(Continued from page 138)

rectifiers have inorganic, non-oxidizing barrier layers which are corrosion and moisture proof and are capable of continuous full-load operation at 50 C without deterioration. The charger is available in 3, 6, 12, 30, and 60-amp models. **Walker Div, Norma-Hoffman Bearings Corp, Stamford, Conn.**



Cable Reel Brake

A cable reel brake for controlling payout of cable, wire, or strand is claimed to have simple design and operation. Brake drum shaft is inserted in bore of tubular reel spindle and welded in place. Anchor asembly bolts to trailer directly under spindle support and prevents brake band from rotating. Adjusting nut on brake band is used to adjust braking force. Brake can be transferred to another reel by exchanging spindle with brake attached.
Utility Tool & Body Co, Inc, Clintonville, Wis.

Induction Heaters

Electronic induction heaters, in ratings of 15, 30, and 40 kw, are offered with up to 10 optional features for specific heating applications. Options include built-in high frequency output transformer, stepless power control, built-in heat exchanger and pump, power tap switch, ceramic water columns, electronic keying, dustproof cabinet, and constant voltage filament supply. Heaters can be furnished with either one or two-position output. Power tubes reportedly have liberal overload capacity.
Magnathermic Corp, Youngstown, Ohio.

(More New Equipment on page 142)

Permanently install...

this

rugged new thermocouple wire

...on your superheater outlet tubes and steam drums

Here's a thermocouple wire built to take the punishment of continuous use. Install it permanently, for measuring superheater outlet tube temperatures.

Each of the two 14-gauge conductors of the *Chromel Alumel* wire is insulated with felted asbestos. A second layer of braided asbestos covers the whole wire. An outer jacket of stainless steel braid makes the wire resistant to abrasion and vibration, and serviceable at temperatures to 1500 F.

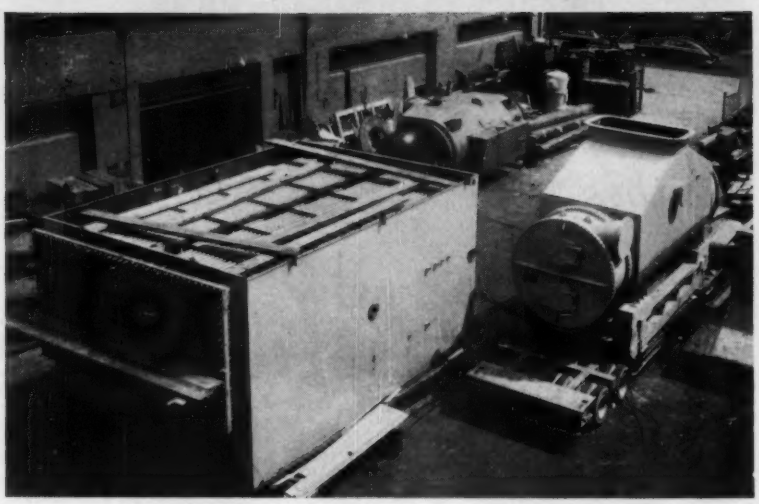
You'll find that this rugged new wire is easy to install and saves you money on several counts. Call your nearby Honeywell office for complete details. It's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Choice of Experience..

CONSECO CONDENSERS



• **CITY OF DETROIT, MICHIGAN**
One 27,500 sq. ft. condenser

• **CITY OF WASHINGTON, INDIANA**
Two 8,500 sq. ft. condensers

This recent photo taken at our shop shows one of the City of Washington units being shipped, the other being fabricated —and the City of Detroit condenser being assembled.

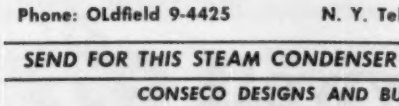
These are small units, compared to many CONSECO has supplied, such as three of 70,000 sq. ft. each for the City of Los Angeles, Cal. . . . one 45,000 plus two 20,000 sq. ft. units for Puerto Rico . . . four 12,000 sq. ft. units and one 35,000 sq. ft. unit for Dairyland Power Cooperative . . . to mention just a few of scores of installations.

Big or small, CONSECO Equipment is the choice of Engineers who have well-placed confidence in CONSECO'S 30 years' experienced engineering, sound design, dependable manufacturing and better performance.

R15

CONDENSER SERVICE & ENGINEERING CO., INC. CONSECO

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries



68 BLOOMFIELD STREET
HOBOKEN, N. J.

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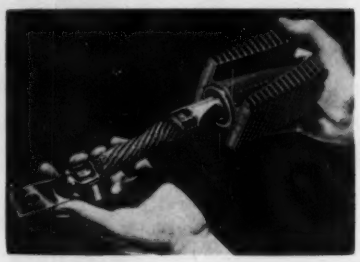
HEAT EXCHANGERS • CONDENSERS • EVAPORATORS • STEAM JET AIR EJECTORS • PRESSURE VESSELS • FEED WATER HEATERS • SEWAGE EJECTORS • CONDENSATE COOLERS • ENGINE PARTS • SERVICE WATER COOLERS • FILTERS and STRAINERS • INSTRUMENTS • SPECIALTY ITEMS

COMPLETE BULLETINS SENT ON REQUEST

Gearmotor

Said to be simple and flexible, the Line-O-Drive gearmotors have output speed ranges between 350 and 7.5 rpm. Double and triple reduction units, with foot and flange mountings, vertical or horizontal are offered. To minimize downtime on automated lines, motors may be removed by loosening four bolts and uncoupling flexible coupling. Speed reducer ratios up to 1478:1 are available.

Howell Electric Motors Co, Howell, Mich.



Germanium Rectifiers

A series of six germanium power rectifier junctions is rated 330 amp at voltages from 20 to 66 v rms. Claimed to be conservatively rated, with low current density, series features corrosion and moisture resistant cast aluminum housings with airfoil cooling fins. Measuring 4.09 x 3 x 3.25 in., it has a reported efficiency of 98.5%.

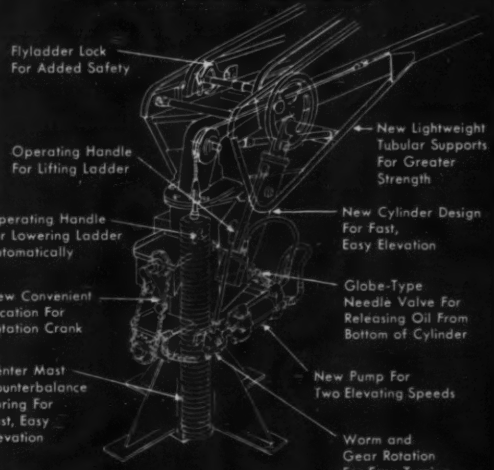
International Rectifier Corp, 1521 E Grand Ave, El Segundo, Cal.

MORE NEW PRODUCTS

Square D Co, 6060 Rivard St, Detroit 11, Mich., offers a 3-pole, 50-amp, 240-v frame **circuit breaker** for combination lighting and distribution panels. Quick-break, quick-make operating mechanism has both thermal and independent magnetic trip.

Bristol Co, Waterbury 20, Conn., offers weatherproof **recording guages** for pressure, vacuum, and water or liquid level measurements. Designed for outdoor wall or pole mounting, they are available in 8-in. and 12-in. chart models.

NEW 2500 SERIES MANUALLY-OPERATED HYDRAULIC LADDER


Flyladder Lock For Added Safety
Operating Handle For Lifting Ladder
Operating Handle For Lowering Ladder Automatically
New Convenient Location For Rotation Crank
Center Mast Counterbalance Spring For Fast, Easy Elevation
New Lightweight Tubular Supports For Greater Strength
New Cylinder Design For Fast, Easy Elevation
Globe-Type Needle Valve For Releasing Oil From Bottom of Cylinder
New Pump For Two Elevating Speeds
Worm and Gear Rotation For Easy Turning

NEW WAY TO GET UP IN THE WORLD

The Holan 2500 Manually-operated Hydraulic Ladder does things no other mechanical ladder can do. With a low-pressure hydraulic system and center mast counterbalancing, the 2500 raises and lowers fast and easy—in a matter of seconds. Elevating locations are infinite; and the angle of elevation can be changed with ladder fully extended . . . safely and without effort.

Other new features of this newest Holan work-simplifier include tubular ladder supports for lighter weight and greater strength; rotation crank located at rear for easier turning, better view and maximum clearance between ladder and body side; and an optional duo-level platform that assures level footing even at lowest angles.

Write for information about the latest addition to industry's biggest and most versatile aerial ladder family.

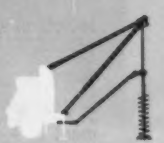
Holan 2500 Manually-operated Hydraulic Ladder with new duo-level platform. Available for 24′, 28′ and 32′ platform-to-ground heights.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Service bodies for chassis up to 1½ ton. Lengths, 72″, 75″, 84″, 90″, and 102″.

Power derricks designed for front or rear mounting. Capacities to 12,000 lbs. Handle poles to 75 feet.

Ladders to 40′ with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter. Also, expertly-engineered mechanical ladders to 32′.



Portable hydraulic and mechanical earth borers. Augers for 8″ to 20″ diameters, depth to 8′.

Hydraulic towers from 17′ to 30′ with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

J.H. HOLAN CORPORATION

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OTHER PLANTS:
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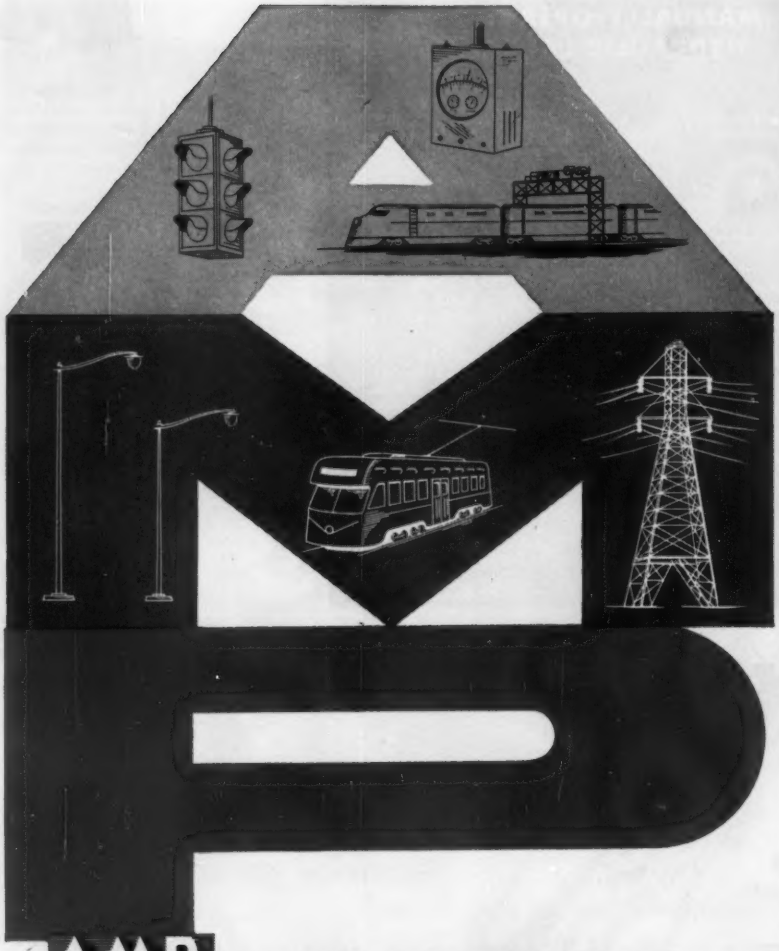
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION



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The ability of electricity to ease, broaden and speed the multiple activities of today's world rests on the promise of uninterrupted service. Failure or breakdown results in disruption and the irretrievable loss of time and money.

A-MP termination assures this promise of constant duty will be kept. No circuit is stronger or more reliable than the terminal at the end of a wire. The development of A-MP solderless termination removed the weakness and slow motion inadequacies of former type connectors.

A-MP solderless terminals have been designed and developed to meet the specific wiring requirements of electrical motivation, whenever and wherever it is generated, distributed, utilized or maintained.

A-MP Terminals, when required for maintenance and repair needs, are made available in the U.S.A. through American Pamcor Inc. api AMERICAN PAMCOR INC.

AMP INCORPORATED

GENERAL OFFICES:

7230 Eisenhower Boulevard, Harrisburg, Pa.

Wholly Owned Subsidiaries: American Pamcor, Inc., Havertown, Pa. (for maintenance and repair needs only) Aircraft Marine Products of Canada, Ltd., Toronto, Canada • Aircraft Marine Products (Great Britain) Ltd., London, England • Societe AMP de France, Le Pre St. Gervais, Seine, France • AMP-Holland N.V's Hertogenbosch, Holland

Distributor in Japan: Oriental Terminal Products Co., Ltd., Tokyo, Japan

BOOKS

Books Received Since May 22, 1957

Principles of Electric and Magnetic Circuits, 2nd Edition. By Warren B. Boast. Published by Harper & Brothers, 69 East 23rd Street, New York 16, N. Y. 357 pages, illustrated. Price $5.50.

Digital Computer Programming. By D. D. McCracken. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York. 230 pages, Price $7.75.

A Second Course in Electricity. By A. E. E. McKenzie. Published by Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 309 pages, illustrated. Price $3.50.

The Theory of Networks in Electrical Communication and Other Fields. By F. E. Rogers. Published by MacDonald & Co., 16 Maddox Street, London, W. 1, 554 pages, illustrated. Price 65s. net.

Iron and Steel Industry—A to Z

An Encyclopedia of the Iron & Steel Industry. Compiled by A. K. Osborne, Published by Philosophical Library, Inc., 15 East 40th Street, New York 16, N. Y. 558 pages, illustrated. Price $25.00.

This reference book provides a concise description of the materials, plant, tools, and processes used in the iron and steel industry. It gives a rather complete definition of the technical terms used in the industry and covers all phases of the industry from the preparation of the ore to the finished product.

The book gives a wealth of broad information on this industry but seems to have rather limited value for utility engineers.

Introduction to Transistors

Transistors in Radio & Television. By Milton S. Kiver. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y. 320 pages, illustrated. Price $6.50

Written to provide a working knowledge of transistors for radio and electronic technicians, this book combines a survey of basic theory with a great deal of practical application and maintenance information. Readers need have no prior knowledge of the subject. Mathematics is limited to a few simple, algebraic equations.

A major portion of the book is devoted to junction and point-contact transistor operation and their use in oscillators, amplifiers, and receivers A discussion of photosensitive, 4-terminal, PNIN, two-emitter, and silicon types brings the reader up to date on latest developments. The practical side of the subject is emphasized by chapters on transistor and printed circuit servicing techniques. Extensive transistor data tables and numerous simple but effective charts and diagrams supplement the text.

This book should be invaluable either for training utility communications personnel or for self study.

209-ft Tower Used in High-Level Crossing in Ohio

Crossing highlights completion of utility's 62-mi, 138-kv line from new plant to Columbus area

The high-level crossing shown in the photograph was the most spectacular aspect of construction of an important transmission line. The double-circuit suspension-type steel tower, fabricated by Bethlehem, will support one end of a 1010-ft span over the line of another utility. The other crossing tower, only 126 ft in height, will actually reach somewhat higher because it is located on more elevated ground.

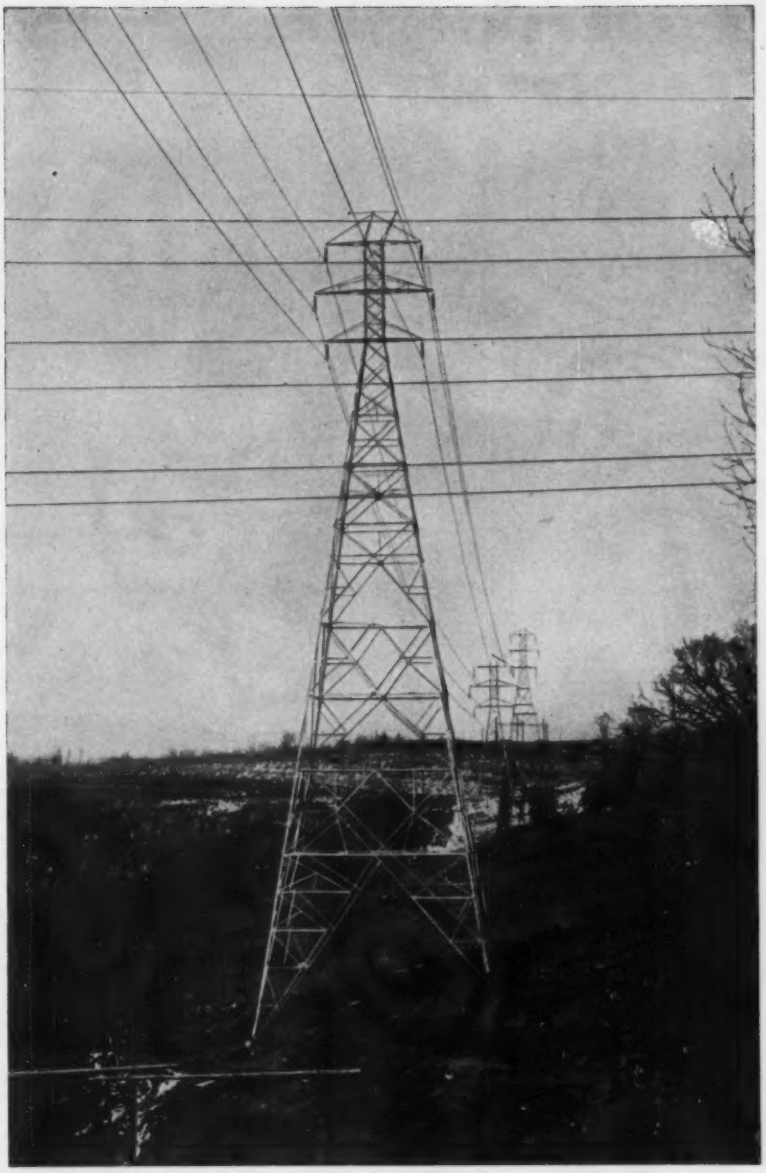
The transmission line is a project of Columbus and Southern Ohio Electric Company which serves all or parts of 23 counties in the central and southern portions of the state.

62-MI LINE . . . The utility is installing this double-circuit line between their new Conesville Generating Plant, located near Coshocton, Ohio, and a major substation located on Morse Road northeast of Columbus. A total of 282 towers were needed to cover the 62 mi.

Specifications call for 1,272 MCM ACSR 45/7 power conductors and ⅜-in. EHS 7-strand Bethanized grade B steel static wires. Maximum design tension under heavy loading conditions for the conductors is 15,570 lbs, and 6,078 lbs for the static wires.

SHIPPED FROM LEETSDALE . . . The 282 galvanized steel towers required for the line were fabricated at our Leetsdale, Pa., tower shop, near Pittsburgh. Aside from the two special towers mentioned above, the towers vary in height to 90 ft. They were supplied with variable leg extensions.

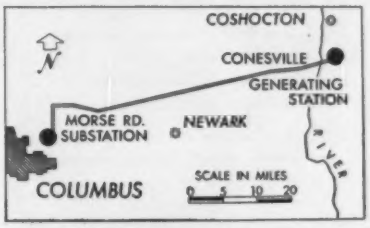
Spans on the line average 1200 ft in length, with a maximum of 2311 ft and a minimum of 427 ft.



This 209-ft crossing tower is the tallest of 282 in the 62-mi Conesville-to-Morse transmission line.

FABRICATING SHOPS . . . In addition to Leetsdale, Bethlehem operates large tower-fabricating facilities at Seattle, Wash., and South San Francisco, Calif. We are fully equipped to design, detail, fabricate and galvanize transmission towers and switching structures.

We would be glad to discuss your requirements with you. Kindly write or call the Bethlehem district sales office nearest you.



Columbus and Southern Ohio Electric Company's new Conesville Generating Station is located about six miles south of Coshocton. The line extends 62 miles to the Morse Road Substation.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

CURRENT TRANSFORMER FIELD TEST SET

NEW!

Check your current transformer installation quickly with this NEW TESCO instrument; pinpoint sources of possible trouble in short-circuiting, faulty connections, instrument tampering, and grounding.

A special new feature now available in this instrument is the spread of resistance burdens — .5, 1, 2 or 4 ohms. The lower burden values are recorded for testing the small size low capacity current transformers, which are widely used on low voltage installations.

2½" panel instrument is easily read. Transparent unbreakable plastic cover. Overall dimensions 6⅞" x 5¼" x 3⅛" high. Weight 2¾ pounds.

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

For full information, write for Bulletin No. 54-B

CATALOGS—BULLETINS

• **COMPANY STORY:** A 24-page booklet is published by and tells the story of Controls Co of America, Schiller Park, Ill.

• **COOLING TOWERS:** A 32-page bulletin, No. CT-57-1, describes the induced-draft counterflow cooling tower." Write Foster-Wheeler Corp, 165 Broadway, New York 6, N. Y.

• **WIRE:** Specifications for its Copperply wire are described in an 8-page illustrated booklet issued by National-Standard Co, Niles, Mich.

• **COMPANY PROGRESS REPORT:** A progress report on its activities and accomplishments during 1956 has been published by ALCO Products, Inc, Schenectady 5, N. Y.

• **GAS REGULATORS:** A 40-page catalog covering their complete line of pressure regulators for industrial compressed gases has been made available by Air Reduction Sales Co, Inc, 150 E. 42nd Street, New York 17, N. Y.

• **REVERSIBLE GEARED MOTORS:** A catalog describing its type TYAZ-CE reversible geared motors is available from Barber-Colman Co, Rockford, Ill. Ask for Catalog GR2.

• **FLUORESCENT FIXTURE:** Folder form 3-1256 illustrates the completely luminous plastic-enclosed fluorescent fixture, called the Quentin, made by Fullerton Mfg Corp, Norwalk, Conn.

• **CAPACITORS:** A 36-page bulletin on its line of VAREX capacitors has been issued by Ohio Brass Co, Mansfield, Ohio. Ask for publication No. 1374-H.

• **FARM WATER SUPPLY:** A booklet which answers many questions about home and farm private water supply has been published by F. E. Myers & Bro. Co, Ashland, Ohio.

• **MOTOR MAINTENANCE:** Two bulletins on motor maintenance entitled, "How to Make a Motor Go . . . and Go, and Go, and Go," and "How to Take Step Seven," are available from A-C. Write for bulletins 51X8581 and 51X8582 from Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

• **TURBINE FLOW METER:** An 8-page catalog covers the turbine flow meter made by Fischer & Porter Co, 75 Jacksonville Road, Hatboro, Pa.

• **VOLTAGE REGULATOR:** Catalog Bulletin RN2 provides complete information about L-M's new RSD pole-type voltage regulators. Available from local representative or write the Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

• **TIMERS & MOTORS:** A. W. Haydon Co, has recently released two bulletins: (1) Bulletin AWH MS101 is an Applications Data Sheet for Motors and Elapsed Time Indicators and Bulletin AWH MS102 is an Applications Data Sheet for Repeat Cycle Timers and Time Delay Relays. Write the company at Waterbury, Conn.

• **POLE SETTING EQUIPMENT:** Bulletin No. 944 describes the "Ranger", a combination hydraulic derrick, digger and winch, manufactured by York-Hoover Corp, York, Pa.

• **LIGHT CONTROL EQUIPMENT:** "PACKAGED LUXTROL Light Control Equipment," Bulletin L157P, gives full information on the features, ratings and data on the line of packaged light control assemblies produced by Superior Electric Co, 82 Laurel Street, Bristol, Conn.

• **RACEWAY:** The twinduct electrical surface raceway made by National Electric Products Corp is reviewed in a 4-page bulletin (AIA File No. 31-C-62). Write the company at Two Gateway Center, Pittsburg, Pa.

TECHNICAL LITERATURE

SILICONES—"The Industrial Chemistry, Properties, and Applications of Silicones," by C. E. Reed, presented at the ASTM's 1956 Annual Meeting, is now available from the Society. The paper is the 1956 Edgar Marburg Lecture. 48 pages, $1.50. Write American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

ALUMINUM FORECASTING: A 67-page monograph of a case study of long-range aluminum forecasting has been published by the University of Illinois. J. E. Rosenzweig's "The Demand for Aluminum: A Case Study in Long-Range Forecasting," employs such techniques as trend projections, correlation analysis, and aluminum product forecasting. In addition to its conclusion, the book has two other important aspects: (1) How such techniques work in forecasting the long-range demand for aluminum, and (2) Its usefulness in evaluating the relative effectiveness of the various approaches, and to judge where these techniques will prove most valuable. Price is $1.00. Address Bureau of Economic and Business Research, University of Illinois, Urbana, Ill.

LOADING NETWORK PROTECTORS—EEI has published a "Guide for Loading Network Protectors Installed in Network Manholes or Vaults." Designated publication No. 57-5, it is a report of EEI's Transmission & Distribution Committee. Its purpose is set down as "to establish permissible loading values based on experience for the effective and economic utilization of the installation,"—in this case, the protector. Six pages, price is 25c. Write Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

SILVER OXIDE—CADMIUM BATTERY—Results of tests on the silver oxide-cadmium battery have been published recently by Yardney Electric Co. Tests were performed using the manufacturer's SILCAD battery by Dr. P. L. Howard, Yardney's director of technical operations. They measure the battery's resistance to shock, vibration and acceleration, its life and discharge rates. Comparisons with other types of batteries are included. Free, address Yardney Electric Co, 40-50 Leonard Street, New York, N. Y. Ask for bulletin entitled, "The Silver-Oxide Cadmium Alkaline Secondary Battery."

FIRST STEP

in planning for ELECTRICAL MODERNIZATION —call Graybar!

For decades Graybar has been "part of the team" of hundreds of utilities as they planned their modernization, construction or maintenance programs. This is because Graybar men, from experienced Outside Construction Specialists and trained Salesmen to the Operating and Warehouse people, know and live with your problems day in and day out.

We offer you a service on selection of quality items (some of which are described in the following pages), on price information, and on delivery schedules. We offer you experienced help in solving unusual problems. And, because we can supply *everything* electrical we offer you a means of cutting costs through reduced paper work and time-consuming checking and following of many sources.

Yes, the first step in *any* planning is important. Graybar offices and warehouses are listed on the back cover of this section. If you are planning a modernization project, call Graybar first — for the first step — now or at any time.

746-96

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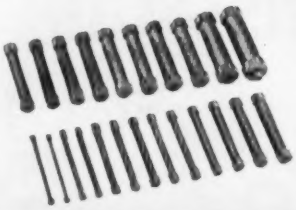
ACSR and All-aluminum Conductors



Line Wire and Service Drop Cables

Tools for Applying Accessories

Your Guide to the Best in Aluminum Value

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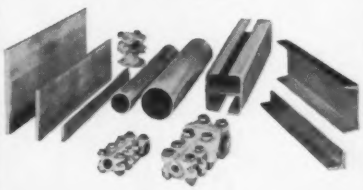
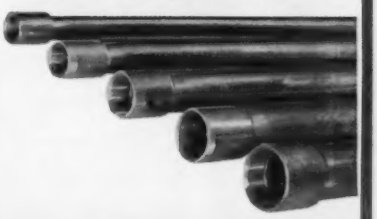
One dependable source for all your electrical conductor and accessory needs

Complete Line of Conductor Accessories

Bus Conductors



Rigid and Thin-wall Conduit



When you go to Graybar and specify Alcoa, you get the best. These two great names are teamed up to offer you:

1 *A single source* for all your aluminum conductors and aluminum accessories; undivided responsibility, less paper work, fewer problems of coordinating delivery schedules.

2 *A complete line* of aluminum conductors and aluminum accessories made for each other. Designed, engineered and produced by the world's most experienced manufacturer.

THE ALCOA HOUR
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ALTERNATE SUNDAY EVENINGS

Always use Alcoa® Aluminum Accessories with aluminum conductors

*Graybar QUALITY SINCE 1869 *REG U.S. PAT OFF.

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PACKAGED AND PRE-MEASURED FOR CONVENIENCE

- Carton protects rope
- Rope stays clean
- Uncoils from carton
- No inner lashing
- Uncoils without kinking
- Easy to handle
- Simplifies inventory

6 Sizes—10 Put-ups
In Individual Cartons

¼", 5/16", ⅜", ½" dia. in 600 and 1200 foot coils—⅝" and ¾" dia. in 600 foot coils only.

All Sizes and Constructions in Full Coils

Time-saving is the big economy in buying American Brand Rope in cartons. Red surface markers every five feet enable you to quickly pull out any desired length of rope. You don't need to keep a long area free for measuring.

Sturdy cartons protect the rope and keep it clean until used. The carton openings assure proper starting of rope to avoid kinks. Additional punch out "plugs" enable you to see how much rope remains in the carton.

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Makers of a Complete Line of Cordage Products

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TWINE, OAKUM, PACKING, BALER TWINE AND ELECTRICAL YARNS

HANDY COILS

¼", 5/16", ⅜" and ½" dia. rope in 100 foot connected coils.

"AMERICAN BRAND"
PURE MANILA ROPE

We can supply "American Brand" Rope in all sizes and types for every utility use.

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4 REASONS WHY RAINIER CROSSARMS belong in YOUR pole-line program

1 **SELECTION** — Extra value in crossarms, as in many other quality products is the end result of *planned manufacture*. With American Crossarm and Conduit Company, careful selection of timber for manufacture of Rainier crossarms is the first important step.

2 **KILN DRYING** — Rainier kiln drying is superior because of scientific control during the seasoning period — correct temperature and the right humidity all the time while in the kiln means all fungus growth killed—timber seasoned throughout.

3 **SEASONING**—Rainier air seasoned crossarms are also carefully seasoned by control of air circulation and by the location of the seasoning sheds, as well as proper piling of the timber during the drying period.

4 **STOCKS** — The American Crossarm and Conduit Company, manufacturers of Rainier crossarms, through Graybar offer the careful buyer of crossarms an additional service — stocks at strategic locations. For planned-ahead buying or for emergencies, this fact is your assurance of lower shipping costs — quicker service.

Remember! **A crossarm produced from improperly or carelessly processed timber might cost less at the time of purchase, but it certainly *is not cheaper per year of life service.***

For further information on crossarms that may pay you dividends in lowered maintenance and replacement costs, write or phone your nearby Graybar Line Construction Specialist. Graybar is located in over 130 principal cities.

AMERICAN CROSSARM AND CONDUIT COMPANY

RAINIER WOOD PRODUCTS TRADE MARK

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"On a low voltage situation, Fusetron dual-element Fuses opened and warned us of the need for a larger transformer"

HERMAN BOND, PRES.
ACME ELECTRIC CO., DENVER, COLO.

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ELECTRICAL CONSTRUCTION
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Everything Electrical
GraybaR ELECTRIC COMPANY

Here's Mr. Bond's own story of how Fusetron fuses helped solve the low voltage situation.

"A flock of Fusetron dual-element fuses blew one afternoon at the Duffy Bottling Works several weeks after we had completed changing the entire plant to this type of fuse in an effort to eliminate extreme heating in switches and to get more dependable protection.

"Before putting the circuits back in operation we wanted to find out what had caused the Fusetron fuses to open.

"On checking, we learned that a severe voltage drop occurred whenever the plant was in full operation. The trouble was due to the transformer being too small to keep the voltage at its normal value of 220 volts.

"To prevent the trouble recurring, a larger transformer was installed. Since then, they have had no more low voltage difficulty.

"By opening and warning of the need for a larger transformer, Fusetron fuses not only saved Duffy Bottling Works the expense of possible motor burnout, but also prevented costly slowdowns in their production."

You too, can save money throughout the plant by using Fusetron fuses . . . ***They Provide 10 Point Protection*** ***1.*** High interrupting capacity —protect against short circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes. ***2.*** Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation. ***3.*** Protect against needless blows caused by harmless overloads. ***4.*** Provide thermal protection—for panels and switches against damage from heating due to poor contact. ***5.*** Protect against waste of space and money—permit use of proper size switches and panels. ***6.*** Protect motors against burnout from overloads. ***7.*** Give DOUBLE burnout protection to large motors—without extra cost. ***8.*** Protect motors against burnout due to single phasing. ***9.*** Make protection of small motors simple and inexpensive. ***10.*** Protect coils, transformers and solenoids against burnout.

DON'T RISK LOSSES! One lost motor . . . one needless shutdown . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with Fusetron dual-element Fuses. *Write for Bulletin FIS.*

FOR LOADS ABOVE 600 AMPS.—USE BUSS HI-CAP FUSES to coordinate your electrical circuits.

Or. 600 volts or less, BUSS Hi-Cap fuses have an interrupting capacity sufficient to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuits of origin. Write for Bulletin HCS.

BUSSMANN MFG. CO. (Div. of McGraw-Edison Co.)
University at Jefferson, St. Louis 7, Mo.

Play Safe! install FUSETRON dual-element FUSES and BUSS Hi-Cap FUSES throughout entire Electrical System!

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
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BISHOP...

Producer of World Famous

BI-SEAL

(The Electrical Tape With A Memory)

Offers 5 Electrical Tapes for Moisture Sealing, High-Voltage Splicing, Jacketing, Insulation Build-Up, and All-Purpose Taping.

FOR PERMANENT MOISTURE SEALING

Bi-Seal Self-Bonding (polyethylene based) Electrical Tapes. Water absorption as low as .0065%. Operating temperatures range from –55°C. to 85°C. Power factors are .0006 and .0021 for 1000 cycles.

FOR HIGH-VOLTAGE CABLE SPLICING

No. 30 High Voltage Splicing Tape. Developed especially for splicing cables insulated with ozone-resistant compounds and operating at 2000 volts or more. Superior ozone and corona resistance.

FOR PERMANENT CABLE JACKETING

Bi-Prene (neoprene) Jacketing Tape. For splicing neoprene-sheathed cables. Protects against ozone, heat, moisture, sunlight, oil, grease, hydrocarbons and chemicals, particularly acids. Flame resistant.

FOR RAPID INSULATION BUILD-UP

No. 125 Electrical Filler Tape. ⅛" thick insulating compound in tape form. Easy to mold to any shape. Fuses to a solid, flexible mass. For cable splice build-up, covering sharp cornered connectors, padding bus bars, cable end sealing.

Write for complete catalog information.

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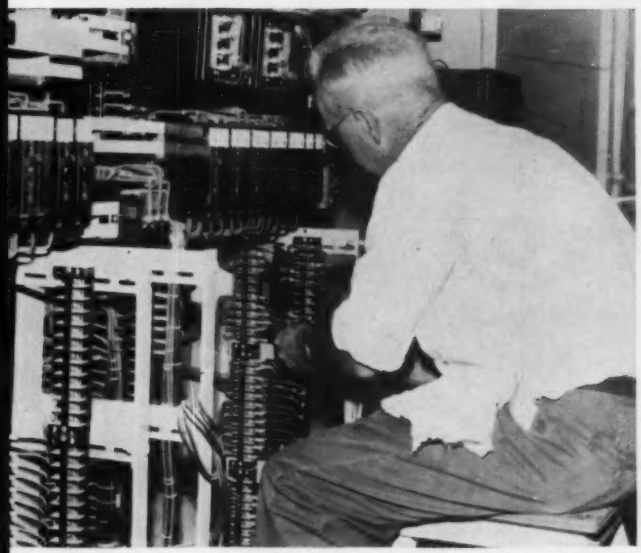
Whatever you want in control cable—Anaconda has it!



PEAK RELIABILITY. Anaconda's Type ANW-rubber-insulated control cable is a high-quality product which features unusual heat resistance. It is also highly resistant to attack by moisture, acids, alkalies and other chemicals. Individual conductor covering and over-all jacket of neoprene.

MULTIPLE USE. Anaconda thermoplastic control cables can be installed aerially, in conduit, underground in ducts—or buried directly in the earth. They are available with either polyethylene (600 or 1000 volts) or Densheath* vinyl resin (600 volts) insulation and Densheath over-all jacket. Also with Densheath conductor covers on request.

OZONE-RESISTANCE. For station control applications where ozone conditions prevail, Anaconda offers a special low-voltage butyl-insulated cable. This control cable not only resists ozone, but individual conductor covering and over-all jacket of neoprene provide maximum insurance against moisture and mechanical injury.

SPACE-SAVER. You can install a 12-conductor cable in conduit now carrying a 6 or 7—with Anaconda Type PND† Control Cable. Individual conductor coverings of moisture-, oil- and gasoline-resistant nylon. Over-all Densheath jacket. Designed for general-purpose control requirements where space is a limiting factor.

Permanent Full Color Coding on rubber cables, by means of Anaconda's rubber-base coating, assures quick and positive circuit identification. Coding by surface printing, which conforms to IPCEA standards, also available. On thermoplastic cables, full color coding with pigmented insulation and surface printed coding are likewise offered. For information on any of Anaconda's Control Cables—including cables engineered for more specialized control requirements—see your Anaconda distributor or the Man from Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. †Trademark 57389

SEE THE MAN FROM ANACONDA® FOR CONTROL CABLE

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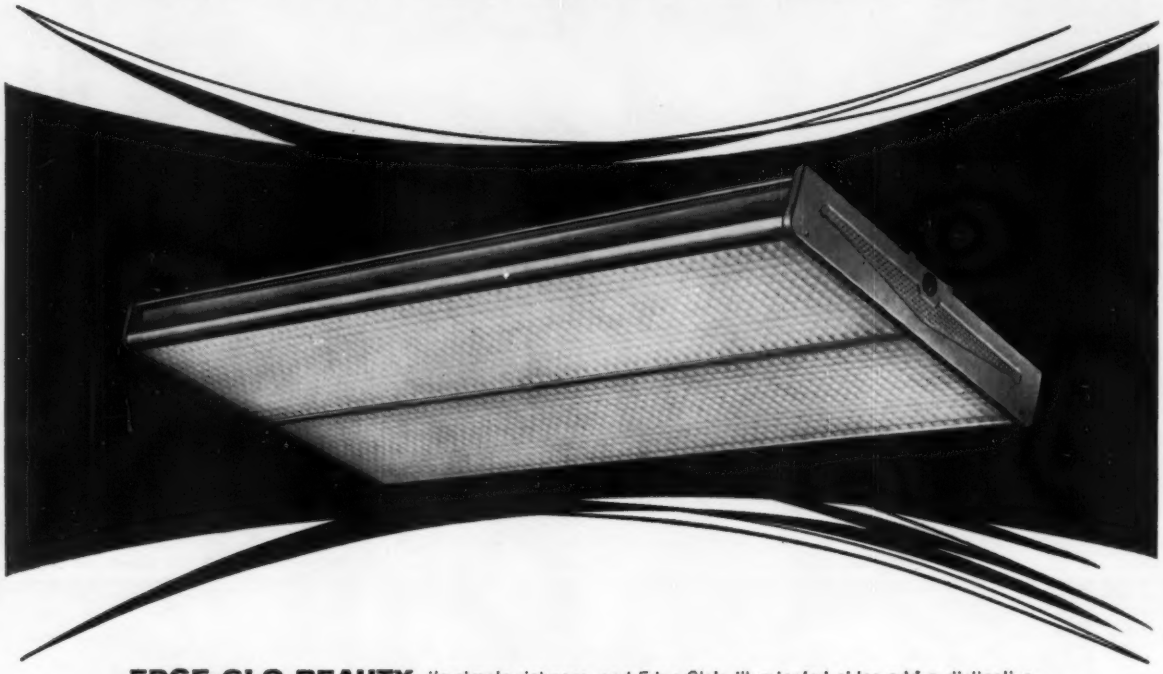
look what you get with
CURTIS EDGE-GLO



EDGE-GLO BEAUTY, its simple richness, and Edge-Glo's illuminated sides add a distinctive touch of exclusiveness to offices, stores or any other interior.

EDGE-GLO VERSATILITY, it's unlimited. There's two sizes, 12¼" for two lamps and 23³⁄₁₆" for four and six lamps; four bottom closures—Holophane Plastic Controlens®, Plastic Egg-Crate, Flat Acrylic and Honeylite—and there's three different finishes—Silver Alzak, Golden Alzak and white Fluracite enamel—all on high purity grade aluminum.

EDGE-GLO EASY INSTALLATION, it's fast and costs less. Units can be direct ceiling mounted over an outlet box with a simple hickey and locknut arrangement, or suspended with Curtis stem hangers. The stem hanger with plastic canopy and positive-lock ferrel eliminates time-wasting set screws. The patented Curtis "Tong" hanger permits suspension at the juncture of two units, and further facilitates and cuts installation costs by permitting the by-passing of beams and sprinkler heads, etc.

This is what you get with Edge-Glo. See it at your authorized Curtis wholesaler or get complete information by sending the coupon below.

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6135 W. 65th St., Chicago 38, Illinois

CURTIS

in California
242 S. Anderson St.
Los Angeles 33, Calif.

•

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195 Wicksteed Ave.
Toronto 17, Canada

Curtis Lighting, Inc., Dept. N-4, 6135 W. 65th St., Chicago 38, Illinois
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CHANCE ANCHORS MEET EVERY GUYING NEED

8-WAY EXPANDING
The guy load is distributed all around the anchor—no wasted space between blades. Usually installed in clay or loam.

NO-WRENCH SCREW
For hand or machine installation. Pitch-controlled blade goes down faster and adds to holding power in sandy soil, soft clay or loam.

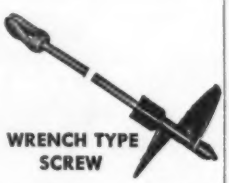
NEVER-CREEP
Made of structural steel. Pulls *entirely* against solid, undisturbed earth. For extra heavy loads in clay or loam.

CROSS-PLATE
For heavy-duty anchoring in machine-bored holes. Holds better than logs or slugs. Saves time and money.

SWAMP SCREW
For swamps, marshes, quicksand, river crossings or seasonally flooded areas. Screws down deeply by adding sections of pipe.

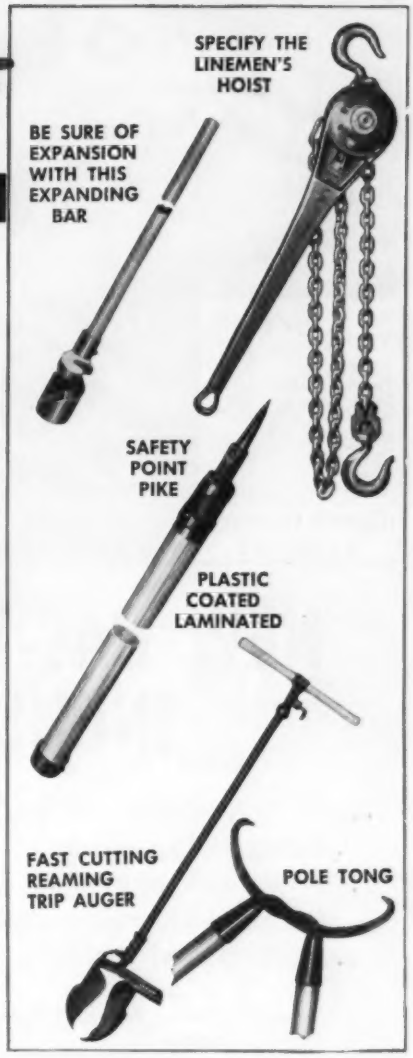
8-WAY CONE
Acts as inverted wedge. Flaring base and flat faces increase wedging action. Used in rocky areas with rock wedging.

EXPANDING ROCK
No grouting necessary. The greater the pull, the tighter it wedges against solid rock. Set in 2" drilled hole.



WRENCH TYPE SCREW
All steel—double arc welded. Anchor hub absorbs installation strain. For light loads in sandy soil, soft clay or loam.

POLE KEY ANCHOR
Keys poles at the butt to reinforce them against unbalanced loads in soft soil. Ideal for congested urban areas.


SPECIFY THE LINEMEN'S HOIST
BE SURE OF EXPANSION WITH THIS EXPANDING BAR
SAFETY POINT PIKE
PLASTIC COATED LAMINATED
FAST CUTTING REAMING TRIP AUGER
POLE TONG

For the Best in Service on the Best in Line Construction and Maintenance Materials Specify CHANCE from GRAYBAR

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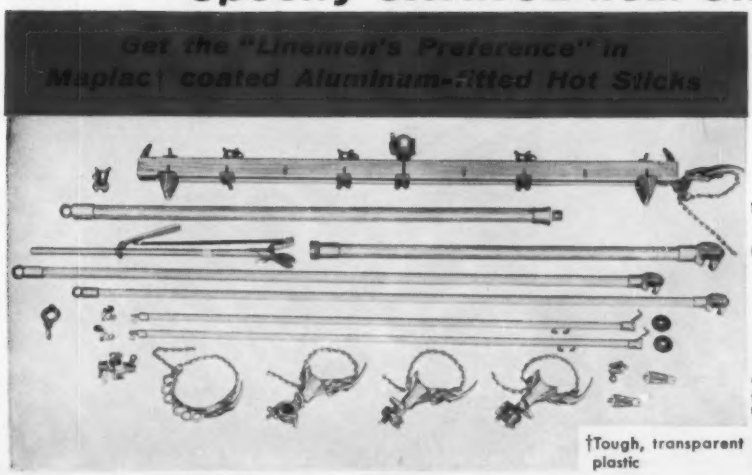

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Keeps Tap Connections Troublefree

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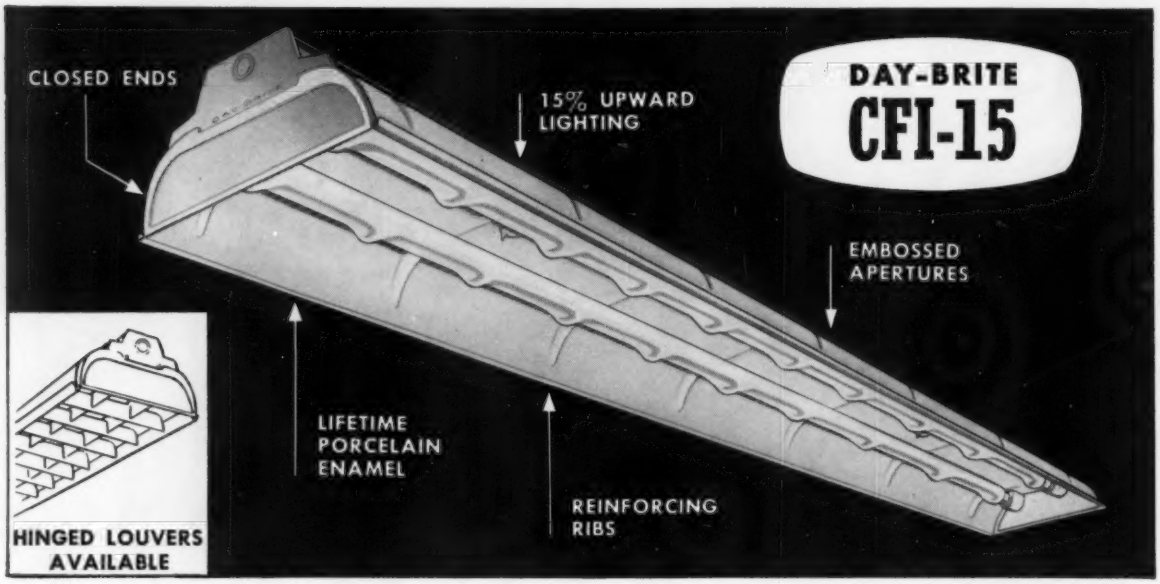

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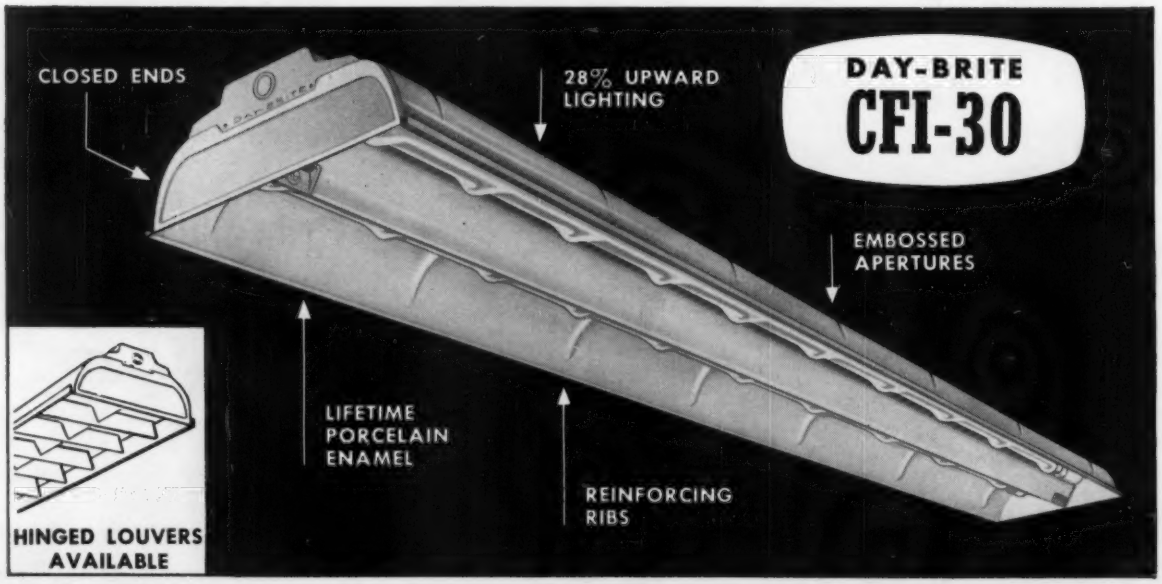

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Coffing Hoists for Safety and Economy

Quik-Lift Electric Hoists

A complete line of 24 models with capacities from 500 to 5000 pounds. Most capacities offer choice of cable or coil chain with two or more lifting speeds.

Super Power Coil Chain Hoists

Compound lever and ratchet-and-pawl construction make them lightest, safest, most efficient hoists in their class. Six models in capacities from 1½ to 5 tons—1½ and 3 ton in aluminum as well as malleable iron.

Safety Pull Roller Chain Hoists

Ratchet-and-pawl construction assures safe operation, and "Safety Valve" handle gives before any load-bearing part can fail—warning operator. Ten models in capacities from 1½ to 15 tons.

Challenger Spur Gear Hoists

Light-weight and dependable, the Challenger is available in ½ and one ton capacities. Durable construction and sealed-in lubrication reduce maintenance costs to a minimum.

Mighty-Midget Pullers

Light and compact—500 pound model weighs but 6½ pounds, 1000 pound model but 9½. Handle can be used either as a lever or a high speed crank.

Duff-Norton Jacks Save Time, Energy and Money

Pole-Pulling Jacks

Duff-Norton pole-pulling jacks will pull or straighten utility poles without laborious digging. Hinged channel base permits jack operation at an angle or upright as required. Service need not be interrupted when these jacks are used.

Cable Reel Jacks (single action)

Jacks are equipped with adjustable cable reel lift incorporating a steel hook which can be placed at any point on the lifting rack. Reels of different diameters can be picked up at any height. Five ton model 524MCR is especially adaptable to warehouse use for handling cable, wire, hemp rope, leather belting and the like.

DUFF-NORTON

Duff-Norton Company

MAIN PLANT AND GENERAL OFFICES: PITTSBURGH 30, PA.

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Coffing Hoist Division • DANVILLE, ILLINOIS

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EVERSTICK ANCHORS

FOR TOUGH ANCHORING JOBS!

Today's anchoring jobs bring Eversticks to the forefront. They provide tight, safe anchoring . . . always in excess of rated capacities. Easy and quick to install . . . made of finest grade maleable iron with superior rust-resisting qualities and exceptional toughness. Every Everstick is plainly marked for ease of handling and storing.

The nut housing feature of the Everstick prevents rod from slipping thru while installing and provides a solid substantial base for the expanding blades.

There's a complete line of Eversticks for all strain requirements. 15 sizes of 2-way—3-way—4-way types.

EVERSTICK ANCHOR CO., Fairfield, Iowa

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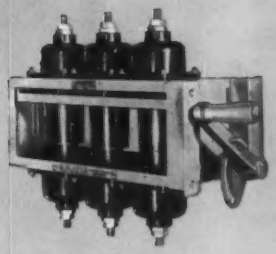
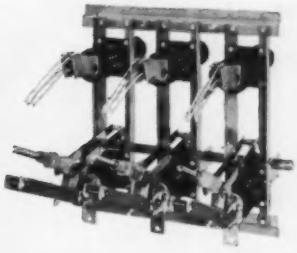
SEE 3E



ISOLATORS

Unmatched for efficiency in disconnecting or interrupting high voltage lines. Straight line action . . . takes only one-third the space needed by comparable knife-type switches. Rated to 15 K.V.

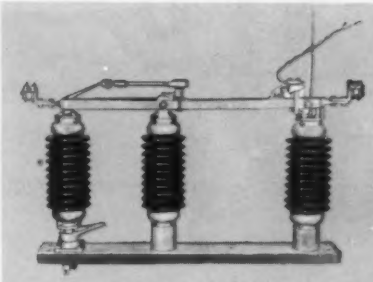
Disconnect Isolators. . . . Bulletin 140
Air Interrupter Isolators Bulletin 138



AIR INTERRUPTER SWITCHES

Auto-Speed interruption is automatically made independent of operator's speed. Dry-type interrupter unit on each pole . . . arc is gas extinguished . . . no inflammable oils or liquids . . . cost less than circuit breakers.

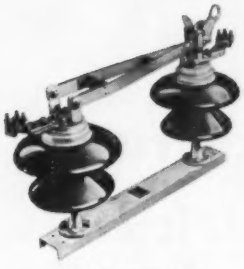
Bulletin 142



8400 AIRBREAK SWITCHES

Straight line current path increases ability to withstand "short time" currents. Special high pressure contacts and braidless design eliminate 90% of usual friction and strain . . . The 8400 is remarkably easy to operate.

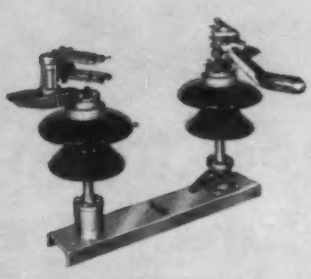
Bulletin 327



DISCONNECTS

Rugged hook stick operated, disconnecting switches. Double blade type, built in full accordance with N.E.M.A. standards. Wide variety of designs. Indoor types rated to 34.5 K.V., outdoor to 161 K.V.

Indoor Disconnects. . . . . Bulletin 139
Outdoor Disconnects. . . . Bulletin 324



SIDE BREAK SWITCH

Pivot motion sets up a powerful ice-shattering and wiping action before the blade starts to open. The best buy in low cost, outdoor switches. High pressure contacts heavy silver overlays, braidless for longer life. Rated to 161 K.V.

Bulletin 335

OUTDOOR BUS SUPPORTS

A complete line of supports for flat or round busses in voltage ratings up to 69 K.V. Mounting devices for flat or pipe mountings. Ruggedly built of top quality materials to N.E.M.A. BIL Standards.

Bulletin 271

CLAMP INSULATORS AND BUS SUPPORTS

Wide range of sizes and types; made of the finest materials; designed for rapid, safe installation; prompt delivery from large stocks.

Clamp Insulators. . . . . Bulletin 201
Indoor Bus Supports. . . . Bulletin 226

SEE 3E FOR EXPERIENCED, VERSATILE ENGINEERING

3E's large engineering staff is especially adept at adapting or combining equipment to suit your exact needs, whether for complete switching centers or additions to existing equipment. See 3E for unusual requirements . . . corrosive or dusty atmospheres . . . unique space demands . . . portable units . . . or a careful design to meet tomorrow's expansion.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

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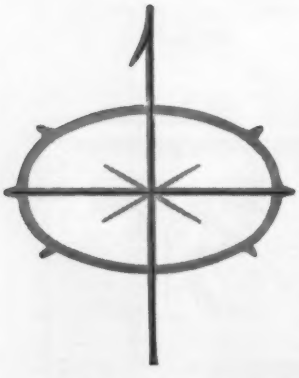
GENERAL CABLE

the largest independent manufacturer of electrical

WIRES and CABLES



QUALITY PRODUCTS to cover every wire and cable requirement.

- **BARE AND WEATHERPROOF**
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  Rubber and Thermoplastic
- **SERVICE CABLES**
- **POWER AND CONTROL CABLES**
  Rubber and Thermoplastic
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- **SAFETY MINERAL INSULATED WIRING SYSTEMS**

for quality and service... **specify GENERAL CABLE**

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faster, easier conduit installations with new, lightweight, versatile

GREENLEE HYDRAULIC CONDUIT BENDER

full 90° bend with one ram stroke

▲ GREENLEE NO. 884 BENDER FOR CONDUIT UP TO 4-INCH

A *powerful* new hydraulic conduit bender that handles 10 sizes of conduit from 4-inch down to ½-inch. Portable . . . versatile . . . easy one-man operation. Makes an accurate 90° bend in 4-inch conduit in only 4 minutes when operated with Greenlee Power Pump, as shown above. Bends of other degrees, in other sizes of pipe, are made with comparable speed and simple operation. Easy to wheel from one location to another. Speeds jobs, cuts costs.

◀ GREENLEE NO. 880 BENDER FOR CONDUIT UP TO 2-INCH

An advanced type, lightweight hydraulic bender for ½-inch through 2-inch conduit. Easily carried, set up, and operated by one man. Lets you make bends exactly where and when needed. Makes a complete 90° bend with one ram stroke. Designed for either hand or power pump operation. Quickly pays for itself in big savings of time and materials.

PORTABLE POWER PUMP

Designed for fast, easy operation of GREENLEE Hydraulic Conduit Benders and other hydraulic tools. The GREENLEE No. 795 AC-SA Hydraulic Power Pump features two-speed action for fast approach and automatic change-over to lower speed, high pressure drive. Operates a hydraulic ram three to five times faster than a hand pump . . . a big timesaver for you!

TOOLS FOR CRAFTSMEN

GREENLEE

SEE YOUR ELECTRICAL DISTRIBUTOR for complete information on above and other GREENLEE timesaving tools for electricians: Knockout Punches • Hydraulic Knockout Punch Drivers • Cable Pullers • Electricians' Bits • Hand Benders for Conduit Chisels and Gouges • and many other fine tools. Greenlee Tool Co., 1806 Columbia, Rockford, Illinois.

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It's Easier, Safer to Wire

. . . Cuts Wiring Time 1/3!

Looks pretty much like the regular Twist-Lock doesn't it . . . But see here — See that dead front? That's the big feature of this Super unit. All the wiring is *enclosed*. There aren't any exposed wires on the surface . . . no need for a fibre disc. The terminals (in both the cap and the connector body) are Pressure Gripped INSIDE. That's why this Super Twist-Lock is so safe and secure.

Is it easy to wire? . . . You bet! There aren't any terminal posts . . . no awkward wire bending or looping. You just press the wires into their individual pockets, screw the dead front in position and it's finished. Six easy steps cut your wiring time up to ⅓rd on any job. That's money in your pocket any way you look at it.

Yes, it's interchangeable with regular Twist-Lock. Use them along with any existing installation. No trouble at all.

Sure, they're available. We have them in stock right now!

HARVEY HUBBELL, INC.

Main Office and Factory — Bridgeport 2, Connecticut

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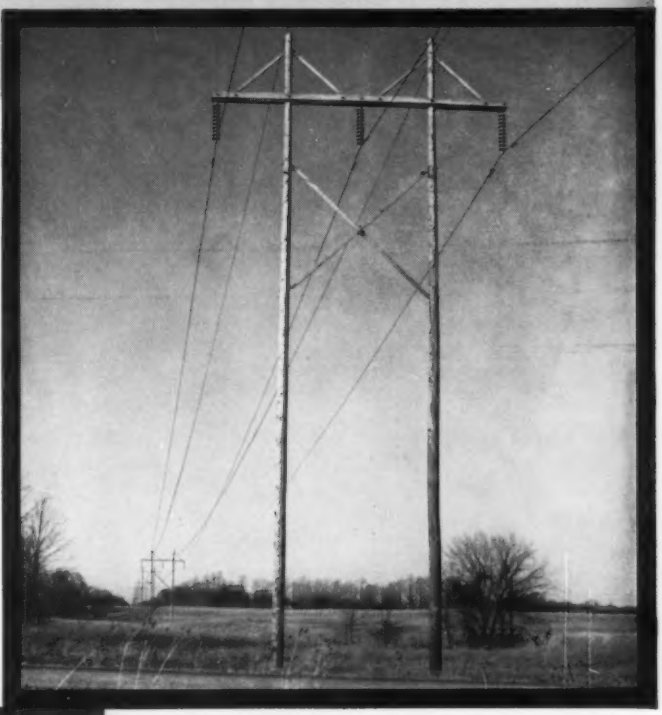
Crapo

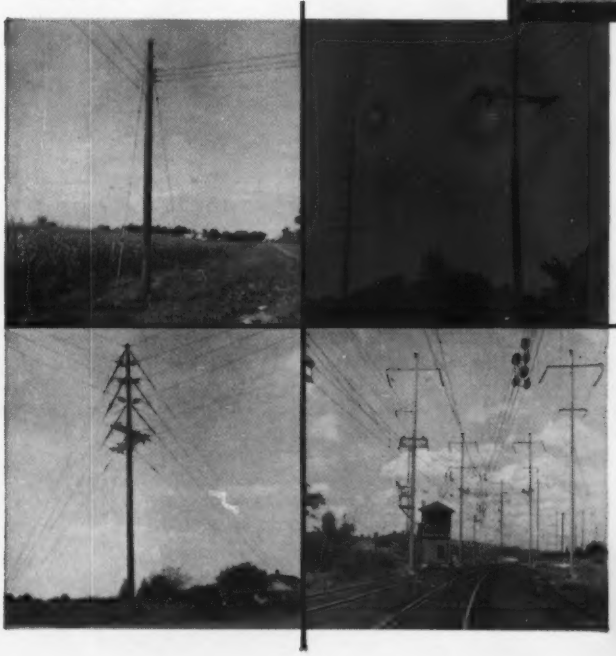
GALVANIZED STEEL STRAND

Your assurance of finest quality, dependability

Close laboratory control of each grade and size of Crapo Galvanized Steel Strand has established this as a product of high quality in the industry. You benefit through maximum strength and dependability of the finished strand.

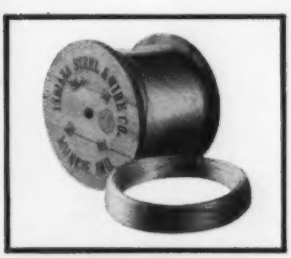
The Crapo Process of applying heavy, uniform, dense coatings of commercially pure zinc, withstands the punishment of construction and provides maximum resistance to corrosion.





OVERHEAD GROUND WIRE . . . from CRAPO Weldless Galvanized Steel Strand.

Here is the most practical and economical strand designed for shielding and protecting transmission lines against lightning. Produced in continuous lengths, Crapo Weldless Strand has no welds or joints in the individual wires or finished strand. Maximum strength and high fatigue endurance provide that extra safety factor so necessary in overhead ground or static wire.



INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

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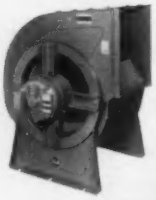
ILG Unit Heaters
The complete line—steam, hot water, gas or electric—with capacities ranging from 18,600 to 286,000 BTU.

ILG Centrifugal Fans
Designed for a wide variety of pressure and volume requirements — certified capacities ranging from 374 CFM to 116,400 CFM.



ILG Power Roof Ventilators
Direct-connected propeller fan and centrifugal fan types. Capacities certified by PFMA Seal.

INSTALL Ilg SELF-COOLED PROPELLER FANS

The secret of ILG's better design is the exclusive *self-cooled* motor! Clean, cool, fresh air is drawn into the motor enclosure through an *outside vent pipe*. The motor stays clean and cools itself — dusty, greasy air can never reach it to interrupt service or shorten its life! ILG self-cooled fans have the lowest operating and maintenance cost of any open type motor combined with a fully enclosed motor . . . a savings up to *10% on power costs alone!*

ILG ELECTRIC VENTILATING CO.
2885 N. Pulaski Road
Chicago 41, Illinois

ILG

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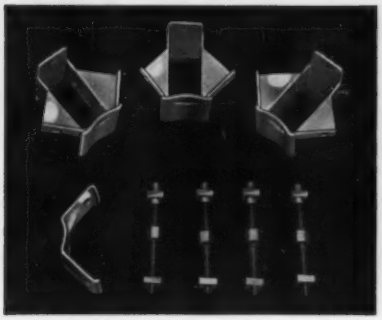
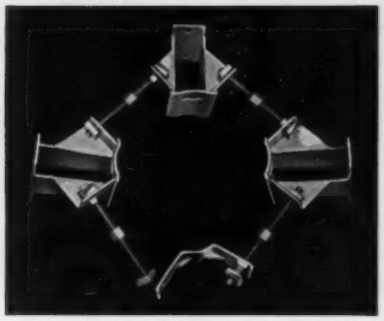
Now one transformer mount fits all poles 6½ to 16 inches in diameter!

New Hub-Mount* takes all EEI-NEMA Transformers 3 kva to 167 kva in one, two, three combinations

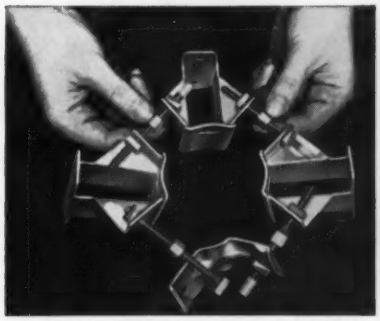




Working scale model demonstrates ease of assembly!

1. HUB-MOUNT assembly is made up of 1, 2 or 3 mounting boxes and quarter plates plus 4 turnbuckle-type bolts. Connecting bolts are fabricated from Cor-Ten steel for long service life. In tests, Hub-Mount has supported more than three times the weight of three 167 kva transformers without any visible deformation!

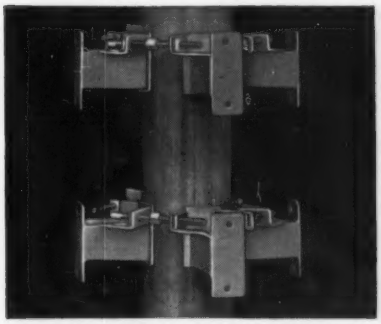
2. GROUND ASSEMBLY. With so few parts, assembly is simple, trouble-free. Left hand bolt threads and nuts are color-coded to speed assembly by eliminating trial and error. Hub-Mount's all steel design eliminates carpentry, periodic maintenance present in platform construction.



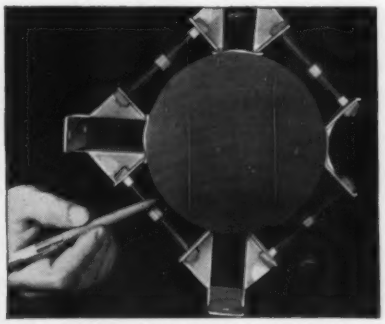
3. GROUND ADJUSTMENT. Turning downward on hex section of turnbuckle bolts adjusts size of Hub-Mount to pole diameter at the point of installation. Hub-Mount has only four points of adjustment. By adjusting three of them on the ground, it is only necessary for the lineman to wrench at one point on the pole.

4. MOUNTING. Hub-Mount is lofted to the pole, hung from one lag screw driven into the pole at the desired height. This leaves the lineman entirely free to complete the installation, by connecting open turnbuckle bolt to quarter plate. Lineman makes his installation from one point on the pole!

5. FINAL ADJUSTMENT. Wrenching downward on the hex section completes installation. When installed, Hub-Mounts work in compression, are not loosened by pole shrinkage. The weight of the transformers causes the Hub-Mount to bind on the pole, thereby maintaining a tight grip.



6. READY FOR TRANSFORMERS. This simple, flexible arrangement accommodates all EEI-NEMA transformers from 3 kva to 167 kva in combinations of one, two or three. Hub-Mount's exclusive design places no reliance on welds, which work in compression, do not govern available strength.



7. WRENCH CLEARANCE. Note wrench clearance at maximum adjustment on 16 inch pole diameter.

*Patent Pending

HUBBARD
AND COMPANY

Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano, Texas

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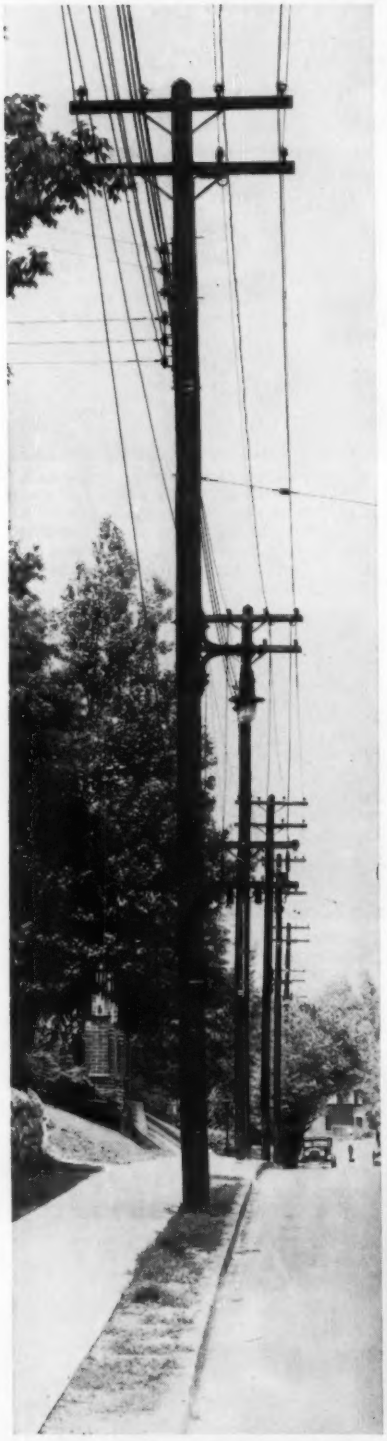
DEPENDABLE



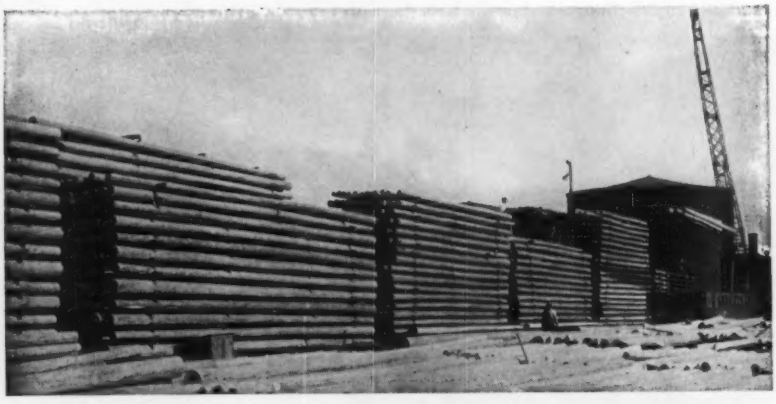
Poles

of
Selected Sound Timber
Scientifically Treated

THE lasting strength of International Creosoted Pine Poles plus their low ultimate cost makes them the safest and most economical poles that can be purchased. For more than 82 years, numerous service records of pole treatments have been utilized to perfect the present production practices for International Creosoted Poles. As a result of the lessons learned during this long experience, International Creosoted Poles will assure trouble-free, continuous service. Their straight, clean, smooth surfaces perfectly adapt them for street lighting, rural and urban distribution.

International Creosoted Pine Poles are manufactured and distributed by two of the oldest companies serving the utility industry. They have grown up together, ready always to serve with quality poles, framed correctly, and shipped when needed.

GraybaR Distributed by GraybaR ELECTRIC COMPANY



INTERNATIONAL CREOSOTING & CONSTRUCTION CO.

PRODUCERS OF HIGH GRADE TREATED TIES, POLES, PILES, ETC.

Galveston — Beaumont — Texarkana

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GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

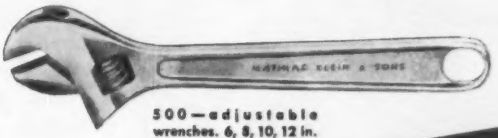
201—famous Klein Side Cutting Plier. Sizes 5, 6, 7, 8 and 9 in.

201-NE—rounded nose side cutting plier. Sizes 5, 6, 7, 8 and 9 in.

213-9NE—high leverage plier. Will cut regular and weatherproof hard drawn copper wire up to No. 2.

301—long nose plier. Available in 5-, 6- and 7-in. sizes. Also may be had with cutters.

202—narrow nose oblique cutting plier. Available in 5- and 6-in. sizes.



500—adjustable wrenches. 6, 8, 10, 12 in.

510—pump plier. One hand operation. Length, 9½ in.

KLEIN TOOLS EST. 1857

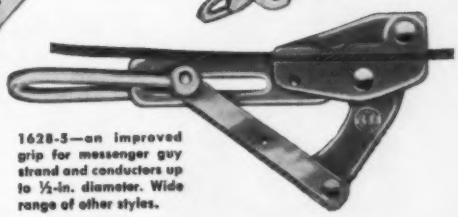
1857 100 YEARS OF SERVICE 1957

a century of progress

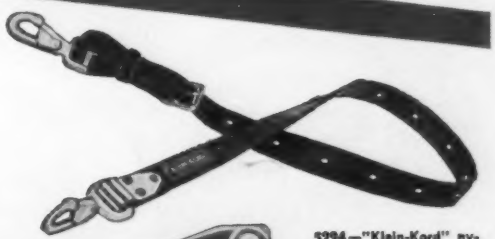
Klein has been the leading supplier of tools and equipment to the electrical industry since the first wires were strung. It was just 100 years ago that Mathias Klein first opened his little forge shop in Chicago. Today the name Klein is known for quality the world over. From **Graybar Electric Company Inc.** you can secure anything you need in tools and equipment for linemen and electricians. Shown here are a few of the popular Klein items available.

5249—linemen's belt. Full floating with "Klein-Kord" sliding trace. One of a complete line.

1945-A—climbers, right and left, adjustable from 15 to 18 in. One of a complete line.



1628-3—an improved grip for messenger guy strand and conductors up to ½-in. diameter. Wide range of other styles.



5294—"Klein-Kord" nylon safety strap made of multiple plies of strong, woven nylon bonded with frictioning and vulcanized in neoprene.

This new Klein Catalog is just off the press. A copy will be sent to anyone interested on request.

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

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GraybaR Since 1869 Everything Electrical GraybaR ELECTRIC COMPANY

PORTABLE CORD

More than 12,000 tests conducted over a 3-year period prove this one cash-saving fact: *Kaiser Wire Portable Cord gives three times longer life than the average of molded cords of other makes.* They're well worth the few extra pennies you pay per foot! For further information, contact your nearest Kaiser Aluminum sales office or the KW distributor listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office,* Kaiser Bldg., Oakland 12, California; *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois.

Kaiser Aluminum

the bright star of metals

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It Pays to have the Right Equipment

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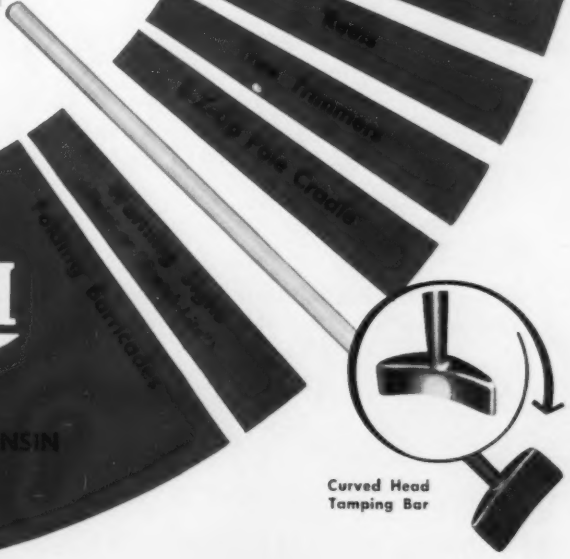
ANY LINEMAN is a better lineman with the superior design and quality of *Oshkosh Tools*

Extension Ladders
Step Ladders
Gaffing Hooks
Climbers
Peavies
Cant Hooks
Shovels
Digging Bars
Pike Poles
Pike Pole Guards
Pole Supports
Tamping Bars
Spoons
Tools
Hammers
Pike Pole Crooks
Folding Barricades

Swivel Point Cant Hook



Curved Head Tamping Bar

OSHKOSH

POLE LINE TOOLS

LEACH COMPANY • OSHKOSH, WISCONSIN

Since 1887

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PRESSURE CONTROLS TEMPERATURE CONTROLS LIQUID LEVEL CONTROLS

ALL MERCOID® CONTROLS

Incorporate SEALED MERCURY CONTACT SWITCHES

FOR INDOOR, OUTDOOR OR HAZARDOUS LOCATIONS

WEATHER RESISTANT

NEMA 1A, 2, 3, 4: For outdoor service and other applications. This type of construction is semi-dust tight; drip tight; weather resistant (weather proof, splash proof, sleet proof, moisture resistant, rain tight) water tight (hose test).

GENERAL PURPOSE

NEMA 1. For indoor service and other general purpose applications where atmospheric conditions are normal. This type of construction serves as a protection against dust, and light indirect splashing.

EXPLOSION PROOF

Class 1 Group C and D (NEMA 7): Atmospheres containing gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvents, vapors and natural gas. Class 2 Group E, F, and G (NEMA 9, 9A): For atmospheres containing metal dust, carbon black, coal or coke dust and grain dust.

Outside Adjustments (No Tools Required)— Visible Settings Over Calibrated Dial—Visible "On-Off" Sealed Mercury Contact—A Wide Selection Of Operating Ranges With Varying Differentials.

Write for catalog No. 857

THE MERCOID CORPORATION, 4201 BELMONT AVENUE, CHICAGO 41, ILLINOIS

FLOAT CONTROLS ALARM RELAYS LEVER ARM CONTROLS THERMOSTATS

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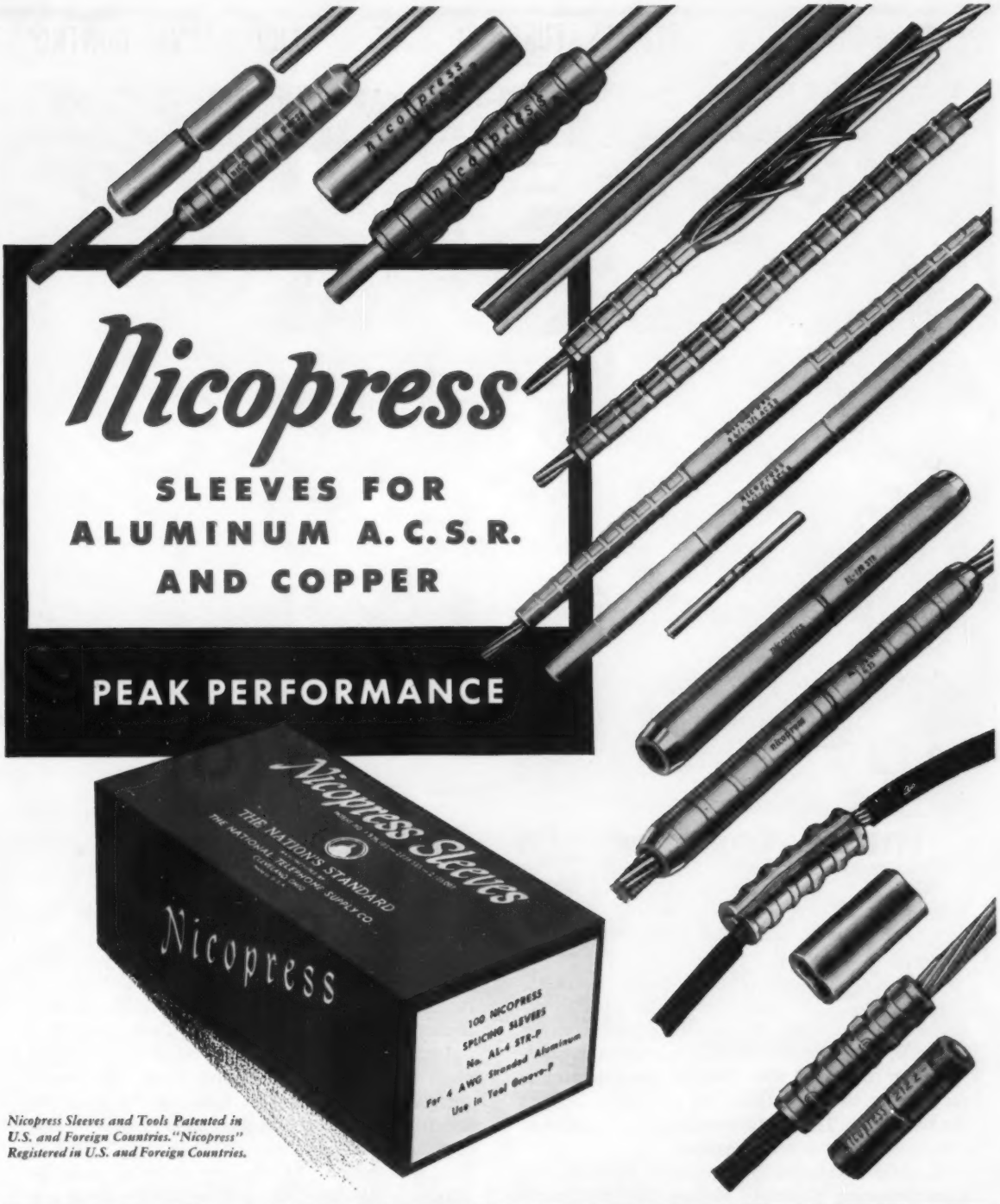

Nicopress Sleeves and Tools Patented in U.S. and Foreign Countries. "Nicopress" Registered in U.S. and Foreign Countries.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

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GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

made together to work together . . .

Shown on this page are a few members from the O-B family of hardware and insulator products for distribution lines.

As in any good family, you'll find a certain "togetherness" of design and materials. This togetherness starts on the drawing board. Often the same man works on both insulators and hardware. Or the man who designs the insulator is just across the aisle from the man who designs the hardware. This gives insulators and hardware a chance "to grow up" together.

A close relationship continues through the manufacturing process. Always the hardware-insulator relationship is considered as a unit, because we know they will serve on your lines as a unit.

The same togetherness applies to hardware components. Despite the numerous combinations of materials, there are no misfits. Balls go with sockets. Clevises and tongues always match.

Items that are designed and made together, work better together on your lines. That's why we recommend going to Graybar for O-B distribution hardware and insulators. You'll be sure of getting materials that fit every time, materials that will perform as effective units in your distribution system. Call on Graybar for these materials that were made for each other.

Distributed by GraybaR ELECTRIC COMPANY

Ohio Brass

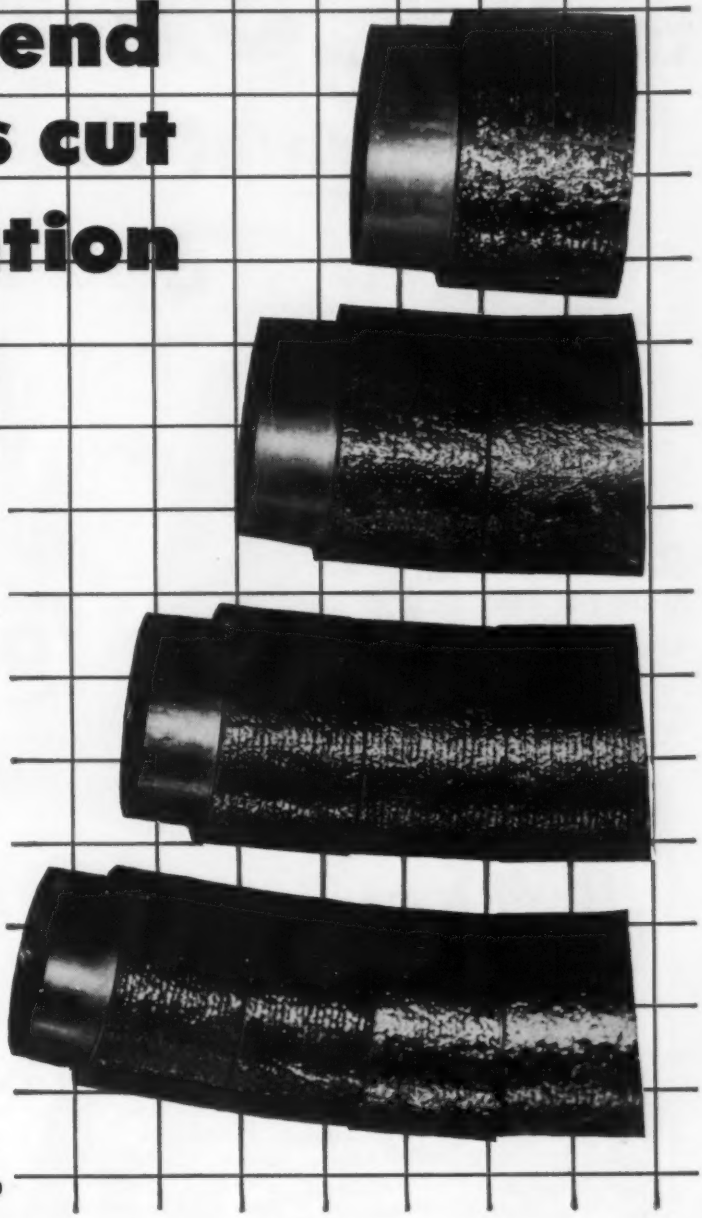
MANSFIELD (B) OHIO, U.S.A.

4672-H

TO MEET EVERY NEED FOR ELECTRICAL CONSTRUCTION

CALL GraybaR FOR Everything Electrical GraybaR ELECTRIC COMPANY

These bend sections cut installation costs



Orangeburg 5° Bend Sections are the "on-the-job" answer to special bend problems. They get over, under or around those unforeseen obstructions . . . and do it easily and economically.

Crossovers . . . transformations . . . offsets . . . can be made in the field by joining sections together to obtain the desired direction change. No costly delays . . . no special bends needed.

Orangeburg 5° Bend Sections* are another reason why Orangeburg Fibre Conduit is the ideal protective raceway for underground electrical cables.

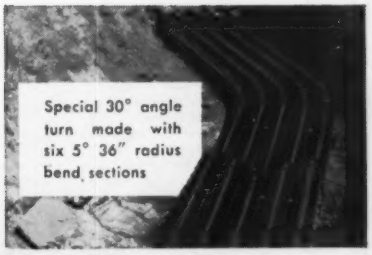
For complete information write Dpt. EW-67A for Bulletin S.E.C.

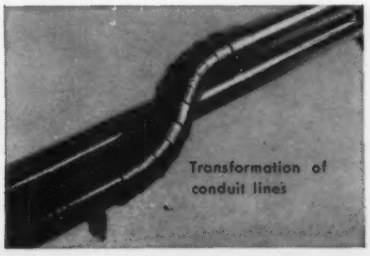
**Made for Orangeburg Standard Conduit only.*

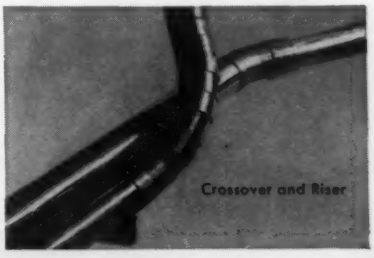
ORANGEBURG MANUFACTURING CO., INC.
Orangeburg, N. Y. Newark, Calif.

ORANGEBURG®

FIBRE CONDUIT PROLONGS CABLE LIFE







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the O.Z. SHURELUG

has more of the features you want...

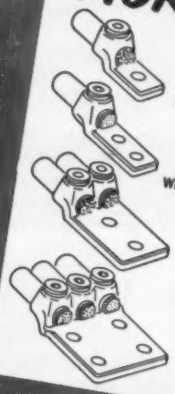
O.Z. means more for you

The O. Z. ShureLug is the newest addition to the complete O. Z. line of electrical fittings; more proof of O. Z.'s policy to make available dependable products at realistic prices.

MORE SIZES

The new O. Z. ShureLug is available for a wide range of sizes, including "in between" sizes usually found only in more expensive makes. This means that whether the job calls for #14 sol. or 1000 MCM cable, there will be an O. Z. ShureLug that will meet your needs more closely, more exactly, for a more secure, more dependable connection.

MORE MODELS



Here's variety too!: O. Z. ShureLug is available in single barrel, double barrel, and triple barrel models . . . with socket heads or hex heads . . . in single hole, double hole, and four hole styles, depending upon sizes selected. Here again, premium selection at practical prices!

MORE ECONOMY

O. Z. ShureLugs are priced no higher than other competitive brands, but you get so much more! Because O. Z. ShureLug is made in more sizes, more models, you buy only the capacity you actually need . . . only the capacity that you'll actually use. Why spend more for over-sized lugs when O. Z. has the size you want, the model you need, at the low economical prices you want to pay?

O.Z. ELECTRICAL MANUFACTURING CO., INC.

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CABLE TERMINATORS
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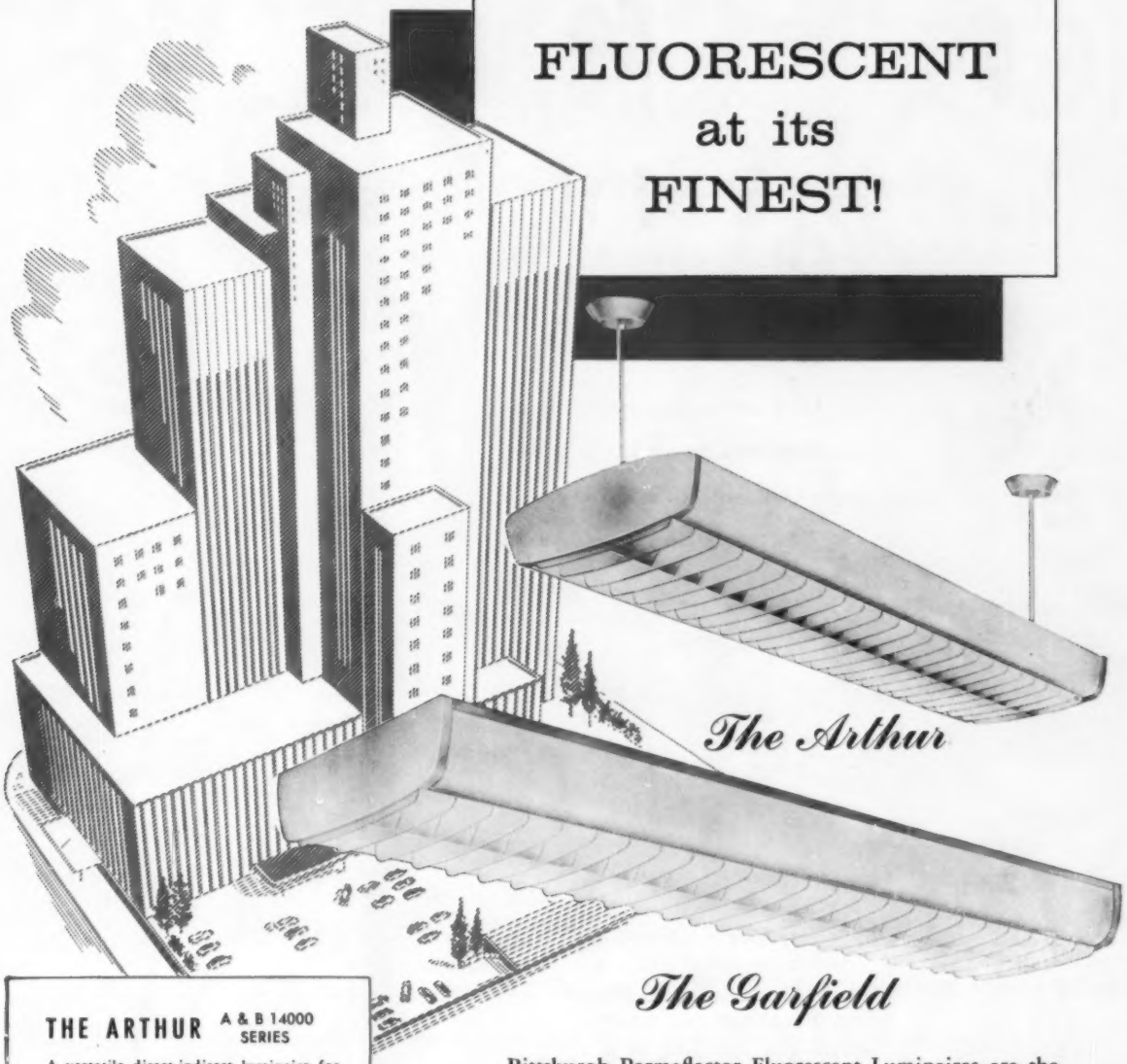
FLUORESCENT at its FINEST!



THE ARTHUR A & B 14000 SERIES

A versatile direct-indirect luminaire for individual or end-to-end pendant mounting. The Arthur is available in 4-foot and 8-foot lengths, in 2 or 4-lamp models. Trim, shallow lines, all white finish, diffused polystyrene side panels and 35° x 35° shielding.

THE GARFIELD A & B 13000 SERIES

The 2 and 4-lamp Garfield is a companion unit to the Arthur, except that it has been especially designed for surface mounting. The long, low lines give it a "built-in" look and make it ideal for surface mounting on low ceilings. Diffusing polystyrene side panels and 35° x 35° shielding.

Pittsburgh Reflector Company

Pittsburgh Permaflector Fluorescent Luminaires are the *first* choice among men who recognize the need for versatility and flexibility in lighting equipment. That's why so many of today's buildings are illuminated with Pittsburgh Permaflector Equipment. In Pittsburgh Luminaires you find modern styling, plus high overall efficiencies . . . and you find a *complete* selection of equipment that is economical in initial cost, easy to install and maintain, and gives maximum efficiency through its long service life.

WRITE The 12-page Bulletin N tells the full story of the gracefully styled Garfield and Arthur Luminaires for direct or indirect lighting.

PITTSBURGH REFLECTOR COMPANY

408 OLIVER BUILDING, PITTSBURGH 22, PA.

In Canada: Pittsburgh Reflector of Canada, Ltd., 105 Tycos Drive, Toronto

REPRESENTATIVES IN PRINCIPAL CITIES • WHOLESALERS EVERYWHERE

TO MEET EVERY NEED FOR **ELECTRICAL CONSTRUCTION**

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Where is the Guy who put up this guy?

He's doing something else—
maybe he's putting up another one.
Anyway, he did this job all alone
in less than five minutes—
by himself.

STRANDVISE is made for strand sizes 3/16", 1/4", 5/16", 3/8", and 7/16"
NO MATTER THE GRADE.
Please pick your size, fill in the coupon and mail it today.

Reliable

Reliable Electric Company
West Carroll Avenue
Chicago 12, Ill.

Mr. Reliable:
WE DON'T BELIEVE IT BUT—we want to give STRANDVISE a fair trial. You may send 4 of them size ( ) without charge. Better send your instructions for installing and a catalog-price sheet, too.

Signed_____

Company_____

Street No._____

City_____ State_____

This STRANDVISE guy was put up complete before any tensioning tools were applied to the strand

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Wire sculpture by Henry Szafarz

The Inside Story

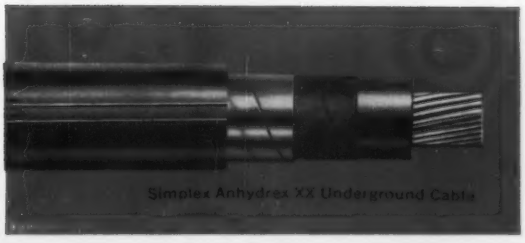
Beneath the surface, there's a lot going on.

An underground river of power surges through innumerable cables, supplying the electrical energy that keeps the entire community rolling smoothly.

Throughout the nation, Simplex products are used extensively in such applications. This is particularly true of ANHYDREX XX, the ideal all-purpose cable for high-voltage use. This expertly engineered cable is popularly employed in the 2001 to 35,000 volt range, and has a Conductor Temperature Rating of 90°C up to 5 KV (a rating never attained before the development of ANHYDREX XX).

For more technical data, write for Booklet 1023.

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.



Simplex

LIVE BETTER ELECTRICALLY

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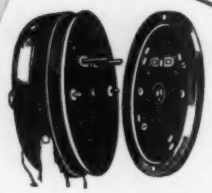
GraybaR Since 1890 Everything Electrical GraybaR ELECTRIC COMPANY

AUDIBLE SIGNALS THAT ARE EASIER TO INSTALL AND INTERCHANGE

Follow these 3 simple steps to Safer, Faster, Easier, Installation

1. Wire to back of dead front adapter plate

2. Secure adapter plate to box or fitting



3. Plug any of 12 Uni-pact signals into adapter plate

Dead front adapter plate eliminates exposed terminals—assures safety.

As easy to install as plugging in a home appliance

You can rely on Sperti Faraday to speed the flow of goods and services in all stages of production and in all walks of life. Pioneers in industrial, commercial and institutional signaling systems, Sperti Faraday precision engineered products meet today's need for maximum efficiency in audible and visual communications. For complete information, write to Sperti Faraday Inc., Adrian, Mich. In Canada, write Sperti Faraday Ltd.

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For Safety's Sake

A DEVICE FOR EVERY ELECTRICAL HAZARD

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RUBBER PROTECTIVE DEVICES

for Linemen

. . . Approved by safety engineers from coast to coast . . . Adopted for safety by public utility companies everywhere . . . Designed for maximum dependability and convenience in use . . . Made from highest grade materials by the pioneers in manufacture of rubber protective equipment for linemen . . . Send for our Utility Catalog.

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MANUFACTURERS SALISBURY CHICAGO RUBBER PRODUCTS

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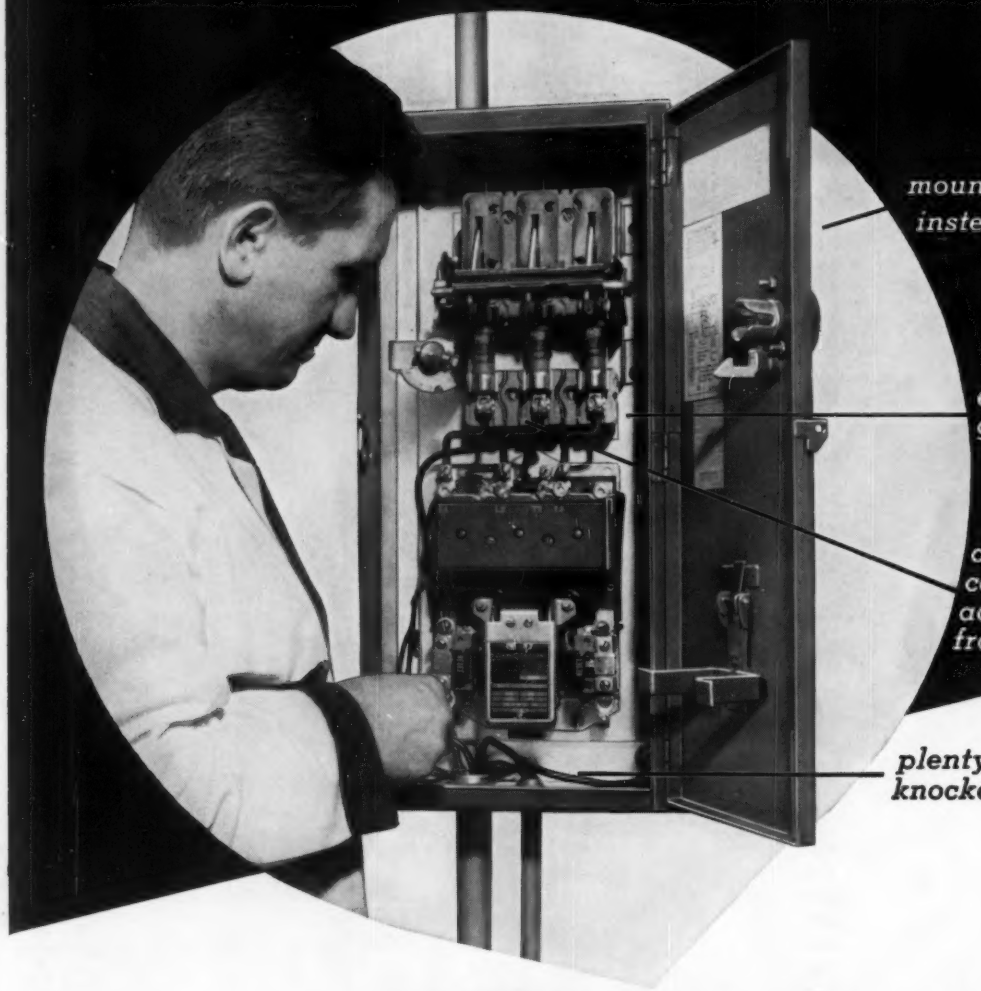
EASIER TO INSTALL AND MAINTAIN!



SQUARE D COMBINATION STARTERS

(Switch or Circuit Breaker Types)
Save space and time. Mount and wire one device instead of two . . . neater, more attractive installations.

COMBINATION STARTERS and other Square D Products are distributed by GRAYBAR

SQUARE D COMPANY

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The best costs less installed

EASY-TO-BEND REPUBLIC ELECTRUNITE E.M.T.

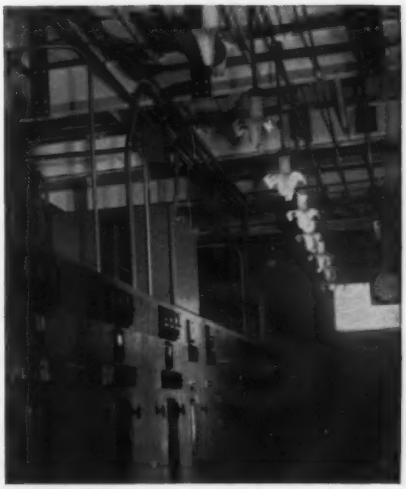
Saves Hours of Installation Time

It's just as dependable, yet *easy* to install! That's why many utilities have changed to Republic ELECTRUNITE E.M.T. They enjoy faster, less costly installations every time.

The exclusive "Inch-Marks" on Republic ELECTRUNITE® E.M.T. assure precise bends without tedious measuring. Light weight means easy handling, lower costs! Uniform ductility leaves surfaces smooth and unwrinkled after bending. The exclusive "Guide-Line" keeps bends in the same plane. And compression-type fittings do away with time-consuming threading!

Dependability? In the hundreds of millions of feet of Republic ELECTRUNITE E.M.T. installed, many users report more than 25 years of trouble-free service. Every joint becomes a union with this conduit. And with no threading, the galvanized coating is left unbroken—maximum protection against corrosion!

Low-cost Republic ELECTRUNITE E.M.T. goes in easy and goes in to stay! It's produced to ASA Specifications C-80.3, Federal Specifications WW-T-806 and carries the Underwriters' Seal of Inspection. Check further into its advantages. Send for your free copy of the 76-page booklet of ELECTRUNITE bending instructions.



CLEVELAND ELECTRIC ILLUMINATING CO. has used Republic ELECTRUNITE E.M.T. in its continuing expansion program. It's easy to install because there are no threads to cut, no runs to turn. This is a big advantage in cramped or multiple-run areas.

REPUBLIC STEEL

REPUBLIC STEEL

Steel and Tubes Division

213 E. 131st Street • Cleveland 8, Ohio

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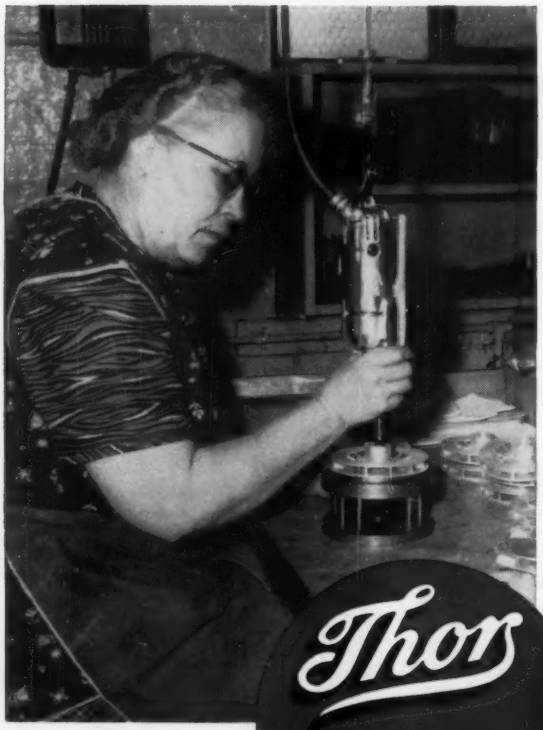
ANNOUNCING

New Thor Electric Screwdrivers and Nutsetters

100% MORE POWERFUL

25% LIGHTER



This is a Thor "EB" screwdriver with lever throttle used in a sub-assembly operation. When used with a precision Thor balancer this tool is at the exact spot the operator desires.

Thor PORTABLE POWER TOOLS

On-the-job tests bring acclaim from users!

Thor doubled the power in the completely new "EB" series of electric screwdrivers and nutsetters—and reduced the weight by one-fourth.

The Thor "EB" series was given thorough testing before release on assembly and sub-assembly lines of appliance and electronic manufacturers. Easy handling and stepped-up power were praised by the manufacturers who put Thor "EB" tools thru the paces.

In the No. 10 capacity class, the "EB" series is available with toggle or lever switches in speeds of 500, 1000, 1500 and 2500 r.p.m. Attachments include double-slip clutch and new Thor Uni-Tork clutch for setting fasteners to a pre-determined torque.

Ball and needle-bearing construction, heavy duty gearing and quality Thor-built armatures are just a few of the 19 engineering improvements which insure long productive life from the new Thor "EB" series of tools. Your Thor distributor will be glad to demonstrate. Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

THOR POWER TOOL COMPANY

CHICAGO

Branches in all principal cities

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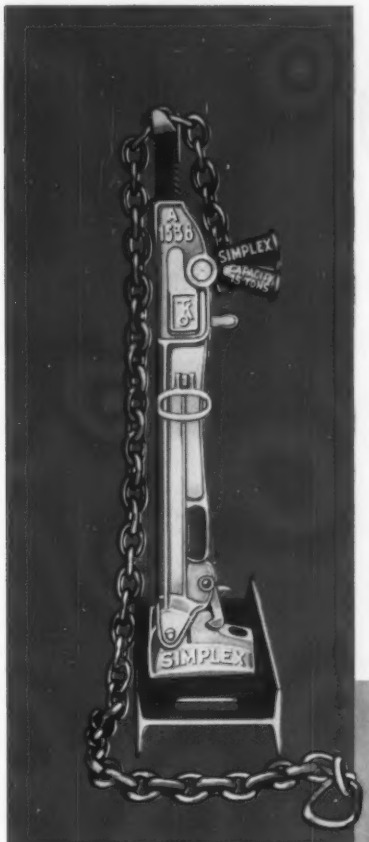

Pull Any Size Pole *Easier*

with the ALUMINUM SIMPLEX POLE JACK

15 Ton Capacity . . . . Weighs only 60 Pounds

Aluminum housing of the Simplex heavy-duty Pole Jack eliminates 35 pounds of weight, without sacrificing a pound of lifting capacity. You can pull or straighten poles, pull butts or move loaded poles without interruption to service—and without digging. Only 60 pounds in weight, it's easy to move from job to job; saves time and work. The husky "I" beam base gives a firm foundation; jack pivots on the base when pawl is disengaged. The A-1538 has 15-ton capacity and 22-inch lift. Comes completely equipped with new alloy steel chain and lever bar.

AERIAL CABLE AND WIRE TENSIONING JACK

Capacity 2 tons.

MANHOLE SHEAVE

Handles up to 3-inches diameter cable or any size winch line.

JUNIOR POLE JACK No. 325

Pulls or straightens poles up to 30 feet high. 5-ton capacity.

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for safe handling of all reel sizes

No. A1029—Single Acting, 10 Ton Capacity. Aluminum alloy housing reduces weight 21 pounds. For outside work where footing may be uneven. T-shaped base has total area of 319 square inches, with three threaded and adjustable steel rods insuring a firm, non-rocking foundation. Furnished with left and right hand bases; Jacks are generally paired to keep operators in sight of each other for even lifting. Handles reels from 36″ to 84″ in diameter. Equipped with 3 lifting hooks 17″, 23″ and 29″, respectively, from ground level. Top hook for 3″ spindles, and the other 2 for 2½″ spindles.

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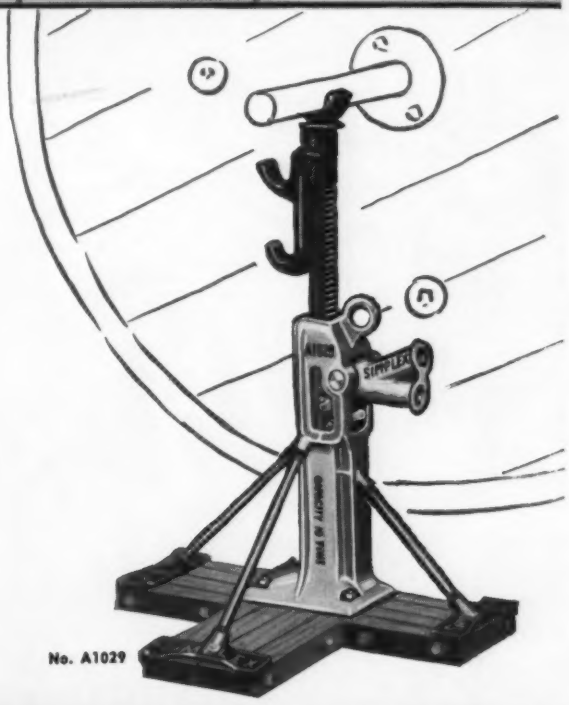

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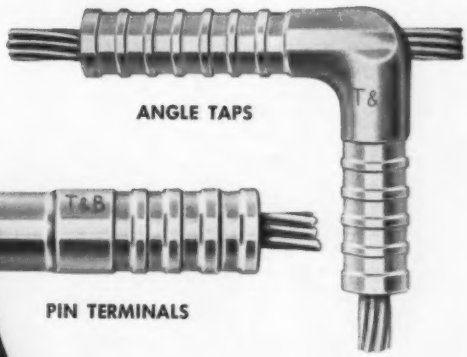

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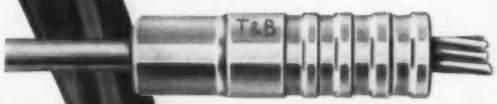

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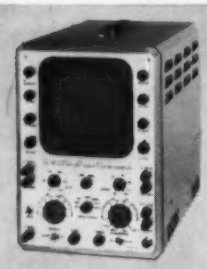

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Weston TUBECHECKER (Model 981)
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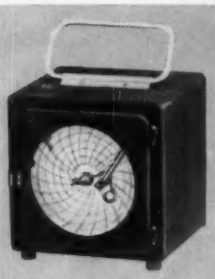

Weston Miniature ELECTRICAL RECORDER (Model 6401)
—ideal for recording current variations—monitoring radio detectors—recording speeds—making life tests on batteries, lamps, etc. Employs Cormag® self-shielded mechanism—size only 6¾"x6¼"x7"—chart size 4" dia. Available in required ranges for a-c or d-c voltage or current measurements.

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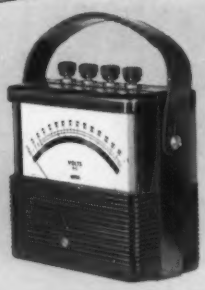

Weston Precision Portables (Model 901)
—provide unequalled scale visibility due to wrap-around windows, efficient shielding, accuracy of 0.5%. Available as d-c voltmeters, volt-ammeters, ammeters and milliammeters—a-c single and 8 range voltmeters, single and 7 range ammeters, milliammeters—also a-c and d-c single phase wattmeters.

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—a versatile, rugged instrument with a combination of functional ranges to cover a wide range of test measurement needs. D-c sensitivity 20,000 ohms/volt, a-c sensitivity 1000 ohms/volt. Range and functional switching greatly simplified by use of a single dial. Accuracy 2% d-c; 3% a-c. Scale length 4.63"—size 6¼"x7½"x3¼".

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—light weight, pocket size, and really rugged. Employs CORMAG® self-shielded, shock-mounted mechanism. Shatter-proof Plexiglas window. One scale for all ranges and functions. Jaws take up to 1" round or 1¾" rectangular conductors. Ranges—current: 300/150/60/30/15/6 amperes a-c...voltage: 600/300/150 volts a-c.

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GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Shipments, Orders and Open Manufacturing Capacity for Electrical Equipment, 1956-1960

Total Capacity Shipped and on Order and Scheduled for Shipment	Shipped 1956	Shipped First 3 Months of 1957	Scheduled as of April 1, 1957: Last 9 Months of 1957	1957	1958	1959	1960 And Later	Total Scheduled for Shipment as of 4-1-57	New Capacity Scheduled 1-1-57 to 4-1-57
LARGE STEAM TURBINE-GENERATORS[2] (10,000 Kw and Larger)[4]									
U. S. El Pwr Sys[1]	6,610,400	1,425,700	9,235,100	10,660,800	13,860,900	10,389,500	1,436,200	34,921,700	2,553,400
U. S. Industrials	391,800	151,900	1,150,100	1,302,000	117,500	600,000	.....	1,867,600	545,000
Outside U. S.	652,600	116,500	402,700	519,200	1,062,900	1,313,700	.....	2,779,300	634,500
TOTAL	**7,654,800**	**1,694,100**	**10,787,900**	**12,482,000**	**15,041,300**	**12,303,200**	**1,436,200**	**39,568,600**	**3,732,900**
Est. Open Capacity[2]	.....	.....	.....	.....	300,000	3,000,000	14,000,000[10]		
SMALL STEAM TURBINE-GENERATORS[3] (4,000 to 9,999 Kw)[4]									
U. S. El Pwr Sys[1]	130,400	15,000	30,600	45,600	31,300	.....	.....	61,900	9,400
U. S. Industrials	80,000	28,100	117,500	145,600	40,600	.....	.....	158,100	20,600
Outside U. S.	91,200	7,500	81,300	88,800	18,700	.....	.....	100,000	5,000
TOTAL	**301,600**	**50,600**	**229,400**	**280,000**	**90,600**	.....	.....	**320,000**	**35,000**
Est. Open Capacity[2]	.....	.....	.....	.....	500,000	1,200,000	1,200,000[10]		
STEAM GENERATORS (450-Psi Pressure and Higher)[5]									
U. S. El Pwr Sys[1]	54,514	19,505	83,054	102,559	92,137	18,610	.....	193,801	17,360
U. S. Industrials	15,175	6,588	20,562	27,150	6,923	.....	.....	27,485	3,860
Outside U. S.	13,518	1,301	12,799	14,100	9,412	2,786	485	25,482	4,789
TOTAL	**83,207**	**27,394**	**116,415**	**143,809**	**108,472**	**21,396**	**485**	**246,768**	**26,009**
Est. Open Capacity[2]	.....	.....	.....	.....	28,000	138,000	170,000[10]		
STEAM GENERATORS (450-Psi Pressure and Higher)[6]									
U. S. El Pwr Sys[1]	64,183	22,380	96,076	118,456	106,840	21,598	.....	224,514	20,089
U. S. Industrials	17,108	7,439	23,836	31,275	8,123	.....	.....	31,959	4,463
Outside U. S.	15,293	1,387	14,430	15,817	10,412	3,279	504	28,625	5,330
TOTAL	**96,584**	**31,206**	**134,342**	**165,548**	**125,375**	**24,877**	**504**	**285,098**	**29,882**
WATERWHEEL GENERATORS[7] (4,000 Kw and Larger)[4]									
U. S. El Pwr Sys[1]	1,085,300	258,000	1,590,000	1,848,000	2,160,500	540,100	78,000	4,368,600	794,600
U. S. Industrials	.....	.....	.....	.....	.....	.....	.....	.....	.....
Outside U. S.	86,500	4,000	43,900	47,900	148,000	.....	.....	191,900	45,000
TOTAL	**1,171,800**	**262,000**	**1,633,900**	**1,895,900**	**2,308,500**	**540,100**	**78,000**	**4,560,500**	**839,600**
Est. Open Capacity[2]	.....	.....	.....	.....	500,000	3,000,000	3,500,000[10]		
HYDRAULIC TURBINES (5,000 Hp and Larger)[8]									
U. S. El Pwr Sys[1]	1,223,700	292,600	2,453,000	2,745,600	2,372,100	2,322,000	2,302,800	9,449,900	2,015,400
U. S. Industrials	.....	.....	.....	.....	.....	.....	.....	.....	.....
Outside U. S.	11,400	.....	107,300	107,300	122,300	.....	.....	229,600	5,000
TOTAL	**1,235,100**	**292,600**	**2,560,300**	**2,852,900**	**2,494,400**	**2,322,000**	**2,302,800**	**9,679,500**	**2,020,400**
Est. Open Capacity[2]	.....	.....	.....	200,000	1,000,000	2,400,000	3,000,000[10]		
POWER TRANSFORMERS (501 Kva and Larger)[9]									
U. S. El Pwr Sys[1]	54,438,000	18,948,000	45,842,000	64,790,000	10,838,000	2,735,000	400,000	59,815,000	20,254,000
Outside U. S.	744,000	271,000	591,000	862,000	.....	.....	.....	591,000	584,000
TOTAL	**55,182,000**	**19,219,000**	**46,433,000**	**65,652,000**	**10,838,000**	**2,735,000**	**400,000**	**60,406,000**	**20,838,000**
Est. Open Capacity[2]	.....	.....	.....	14,000,000	69,000,000	77,000,000	80,000,000[10]		

[1] U. S. Electric Power Systems. [2] Estimated open manufacturing capacity for production of additional units. [3] Manufacturers' maximum rated capability. [4] Figures in Kilowatts. [5] Figures in 1,000 lb steam per hr. [6] Figures in heat output, millions Btu per hr. [7] Manufacturers' rating of generators. [8] Figures in horsepower. [9] Figures in kilovolt-amperes. [10] Estimated open manufacturing capacity only for 1960.

Record 44,449 Mw Scheduled for Shipment

Generating capacity amounting to 44,449 Mw was scheduled for shipment on April 1, 1957, topping the previous record by almost 2,000 Mw on Oct. 1, 1956. This was the highlight in the production of large generating apparatus as brought out by the recently released 21st Semi-Annual Electric Power Survey of Edison Electric Institute.

Five other significant developments in the survey follow. These, too, have established records. Data shown includes totals for three classifications, namely, U. S. electric power systems, U. S. industrials, and outside the U. S., unless otherwise noted.

• Orders for steam generators placed during 1956 had a total steam capacity of 184 million lb per hr. No breakdown figures are available for a prior comparable period; however for U. S. electric systems alone the orders totalled 102 million lb per hr in 1955.

• Backlog of orders for all classes of steam generators totalled 246,768,000 lb per hr of steam. Previous record was 242,460,000 lb per hr as of April 1, 1952.

• Shipments of steam generators during 1957 will have a total steam capacity of 143,809,000 lb per hr. This exceeds the prior high of 119,472,000 lb per hr for 1952.

• Scheduled shipments in 1958 for both thermal and hydraulic generating capacity stands at 17,440 Mw, exceeding the prior high of 14,658 Mw scheduled in 1957.

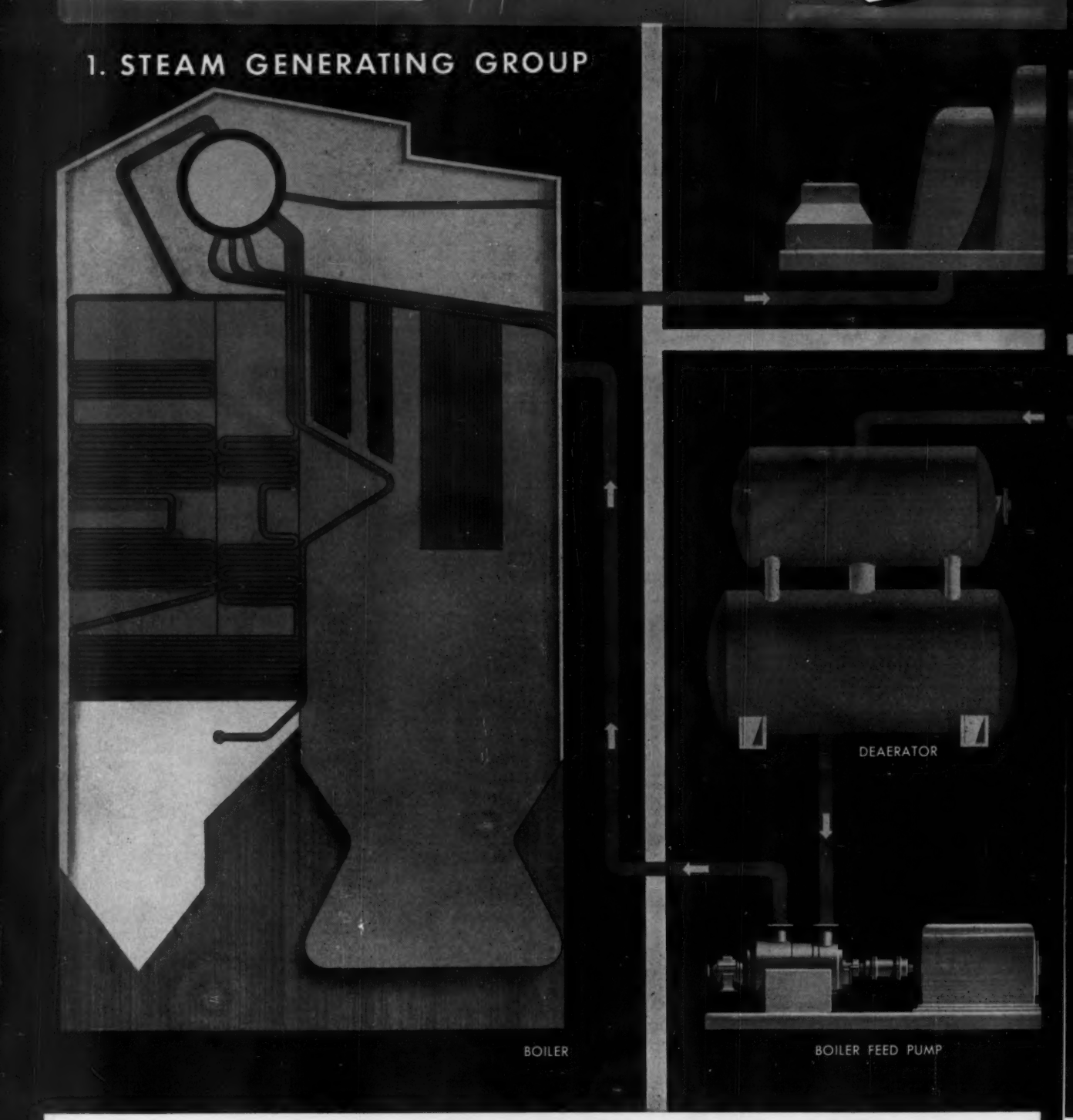
• Backlog of orders for hydraulic turbines totalled 9,679,500 hp as of April 1, 1957. This exceeded by 17% the previous peak of 8,249,900 hp on April 1, 1952.

Other outstanding facts developed by the survey are:

Orders for waterwheel generators in the first quarter of 1957 totalled 840 Mw. If this rate is continued for the remaining three quarters of the year the kw capacity will about double the 1956 total of 1,914 Mw.

Orders for hydraulic turbines in the first quarter of 1957 totalled

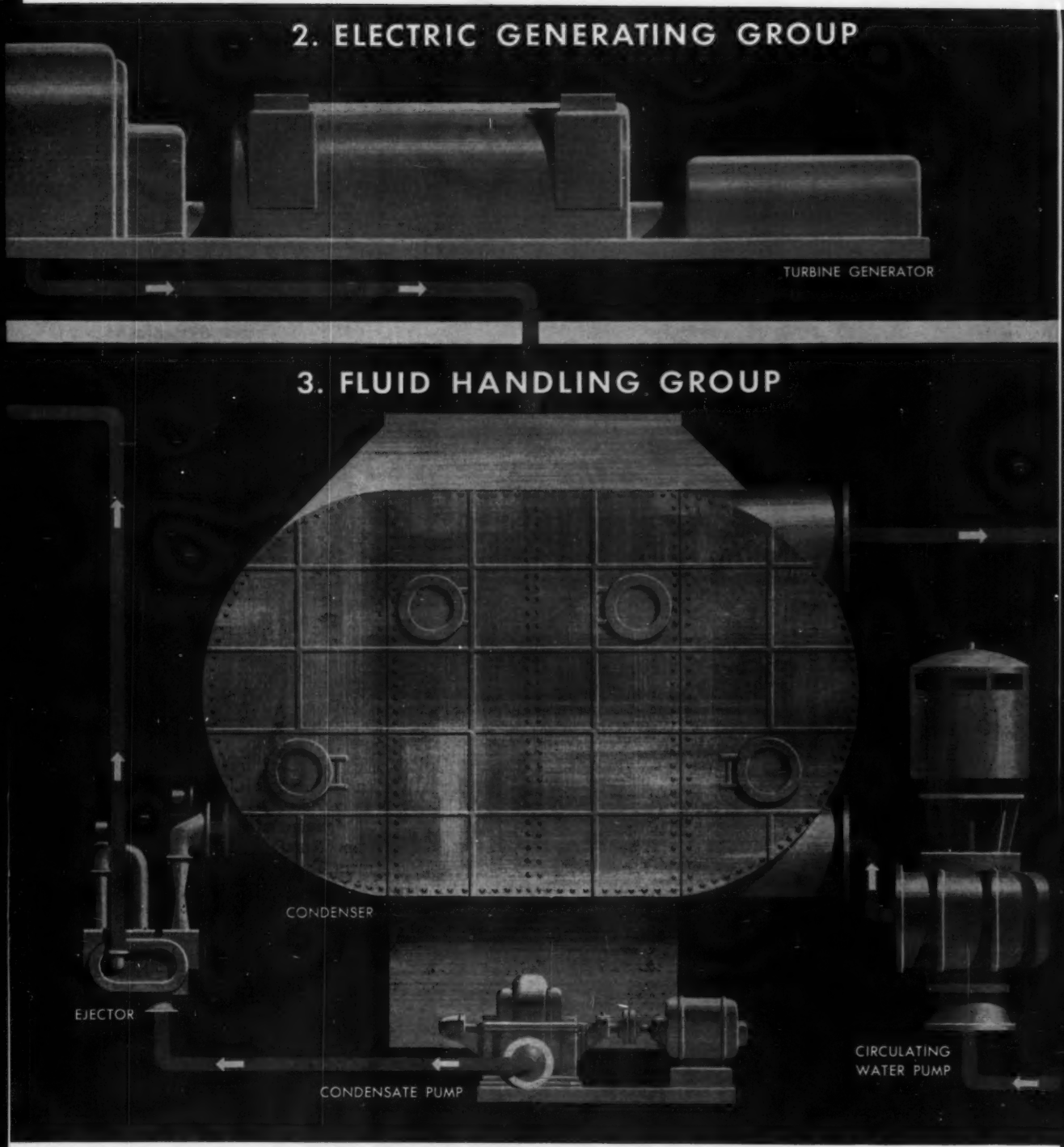
(*Continued on page* 194)



Look at all three

A new steam station design approach is bringing higher efficiencies, lower costs, and greater reliability. In this approach, only three basic functions are considered: (1) Steam Generating, (2) Electric Generating. (3) Fluid Handling. Station requirements are first analyzed in terms of the over-all job performed by each of these groups rather than by each individual piece of equipment.

Many of the benefits of this approach occur in the Fluid Handling Group. Here coordination and integration of the wide variety of equipment used can often effect substantial improvement in over-all operation. As steam temperatures and pressures go up, there are increased demands on the fluid handling function. Plant reliability often depends on the effect of one component of the fluid handling group on another during operational transients, either planned or of emergency nature. The solution is coordinated equipment



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selection, engineering and design. And Worthington's "system" know-how and experience with modern complex plant cycles can help solve your fluid handling problems.

System-wise experience As the manufacturer of all major components of the Fluid Handling Group, Worthington has a reservoir of experience and knowledge that can be of benefit to you. To put this "system-wise" experience to work for you, get in touch with your nearest district office. Or write to section C-71, Worthington Corporation, Harrison, New Jersey.

WORTHINGTON

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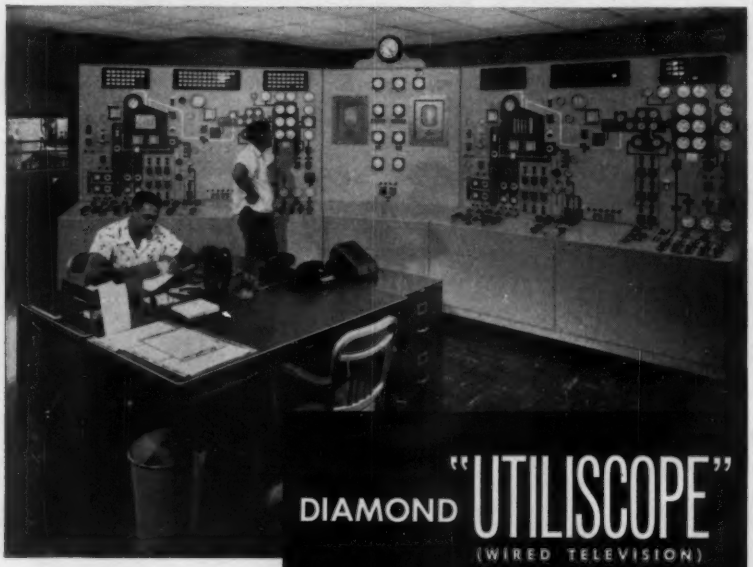

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The Diamond "Utiliscope" makes possible the ultimate in automation for power plant control. It enables the operator to see clearly anything that requires visual check. He no longer need depend upon indirect interpretations to know what is happening outside his range of vision.

The operator in the above photograph is watching the ITV image of the water level in two boilers . . . transmitted by "Utiliscope" cameras focused on Diamond Bi-Color water gauges. The water levels are easily and unmistakably read on the viewing screens. There can be no error . . . the level is shown correctly or there is no picture.

The Diamond "Utiliscope" is heavy duty equipment for power plant application. Other power plant uses are: watching flame conditions in boiler furnances, watching smoke emission from stacks, and watching remote entrances for intruders. Have you explored the "Utiliscope's" resources for saving money and improving operation? Use the coupon below for further information.

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Record 44,449 Mw

(*Continued from page* 191)

2,020,400 hp. If orders continue at this rate for the remainder of the year, they will be 300% of the 1956 total of 2,699,200 hp.

Production of steam turbine-generators in the larger sizes is increasing for U. S. power systems. The class of 200 Mw and higher constituted 32% of scheduled shipments 12 months ago (April 1, 1956); 38% just 6 months ago (Oct. 1, 1956); now 43% as of the latest survey (April 1, 1957).

Largest steam generators on order are for (1) Ohio Power Co's Philip Sporn station Unit No. 5 which will be rated 2,900,000 lb of steam per hr or 3,295,000 Btu per hr, and (2) Indiana & Michigan Electric Co's Reed station Unit No. 1, a duplicate of the foregoing Unit No. 5. These will be operated with 450 Mw steam turbine-generators, the largest units on order (EW Dec. 10, 1956, p 218).

An upward trend is shown in power transformer orders and kva capacity. Orders in 1956 totalled about 67,617 Mva. But 1957's first quarter orders totalled 20,838 Mva, and if this rate continues for the remainder of the year, the 1955 and 1956 rate of ordering will be exceeded.

Manufacturing capacity has been stepped up for three classes of equipment, based on the survey dates of October 1, 1956 and April 1, 1957, as follows:

Steam generator capacity from 155 million lb per hr to 170 million lb per hr; Waterwheel turbines from 3.5 million hp to 3.6 million hp; Power transformers from 74,000 Mva to 80,000 Mva.

Following information on production, shipments and new orders are only for U. S. electric power systems and are included in the table above:

Production . . . Electric generating equipment (4 Mw and larger), thermal and hydraulic, scheduled for production in 1957 totals about 12,554 Mw. This is 4,728 Mw greater than the shipments in 1956; the major increase is in the thermal generating units.

Scheduled production of thermal and hydraulic generating capacity in 1958 (based on April 1, 1957

(*Continued on page* 196)

Standard® TRANSFORMERS

in good company

Standard Transformers have a reputation for keeping company in the best circles, both here and abroad. Standard designs and builds many of its transformers to meet specific requirements, incorporating those components specifically requested by the customer. These custom transformers cost no more than repetitive models and in many cases, because they are custom built, cut costs all the way along the line.

When you ask for bids, or when you place your next order for transformers, include Standard. You'll be following the lead of many outstanding power companies. If you have a specific transformer engineering problem, refer it to Standard. It will receive prompt attention.

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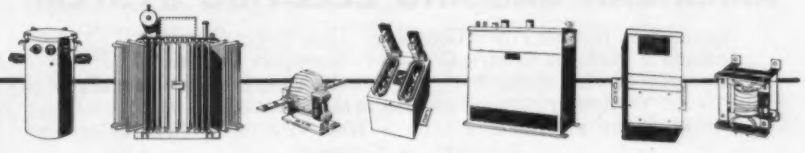
THE STANDARD TRANSFORMER COMPANY

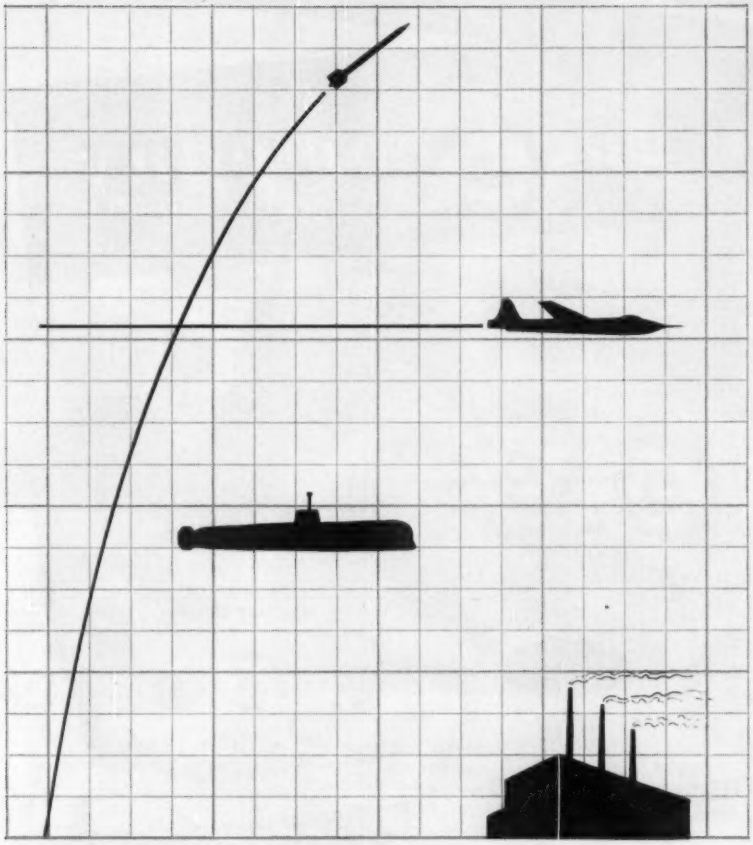
WARREN, OHIO • REPRESENTATIVES IN PRINCIPAL CITIES

Transformers

FOR EVERY APPLICATION



ALL THESE ACHIEVEMENTS WERE THOUGHT IMPOSSIBLE ONLY A FEW YEARS AGO . . . !



A rocket zooming 250 miles into space; man flying faster than the speed of sound; a submarine that travels over 50,000 miles without refueling—all were thought impossible only a few years ago. So, too, was an electric generating unit operating above 3206 psi (pounds per square inch).

In March, 1957, at the AGE System's Philo Plant in Ohio, a new electric generating unit operating at 4500 psi not only became a reality but also the world's most efficient electric producer. With this and resulting technological advances the AGE System will continue to stimulate the dynamic growth of the area it serves through the medium of low cost electric power.

AMERICAN GAS AND ELECTRIC SYSTEM

Appalachian Electric Power Company
Indiana & Michigan Electric Company
Kentucky Power Company
Ohio Power Company
Kingsport Utilities, Inc.
Wheeling Electric Company

Serving 2321 communities in these great states:
Michigan • Indiana • Ohio • West Virginia • Virginia
Kentucky • Tennessee

Record 44,449 Mw

(*Continued from page* 194)

data) totals about 16,053 Mw, in 1959 about 10,930 Mw, and in 1960 and later about 1,514 Mw. The increase in 1958 over 1957 is 3,499 Mw or almost 28%.

Power transformers scheduled for production in 1957 total about 64,790 Mva. This capacity is an increase of 10,352 Mva or almost 20% of the 54,438 Mva shipped in 1956.

Steam turbine-generators scheduled for production for which no boilers have been ordered totals 4,700 Mw, exclusive of the units for use with nuclear reactors.

Seven units scheduled for atomic plants total 989 Mw and are for the following installations: Consolidated Edison Co of N. Y.—250 Mw; Commonwealth Edison Co—192 Mw; Detroit Edison Co—150 Mw; Pennsylvania Power & Light Co—150 Mw; Yankee Atomic Electric Co—125 Mw; Duquesne Light Co—100 Mw; Rural Cooperative Power Association—22 Mw.

Shipments . . . For the first three months of 1957 the following shipments are recorded, with comparisons for the same period in 1956:

Steam turbine-generators (10 Mw and larger) were 1,426 Mw or an increase of about 578 Mw over 1956.

Steam generators had capacities totalling 19,505,000 lb per hr, up 5,366,000 from 14,139,000 in '56.

Waterwheel generators added to 258,000 kw, an increase of 208,200 kw from 49,800 kw in 1956.

Hydraulic turbines amounted to 292,600 hp, or 18,000 hp over the 274,600 hp in 1956.

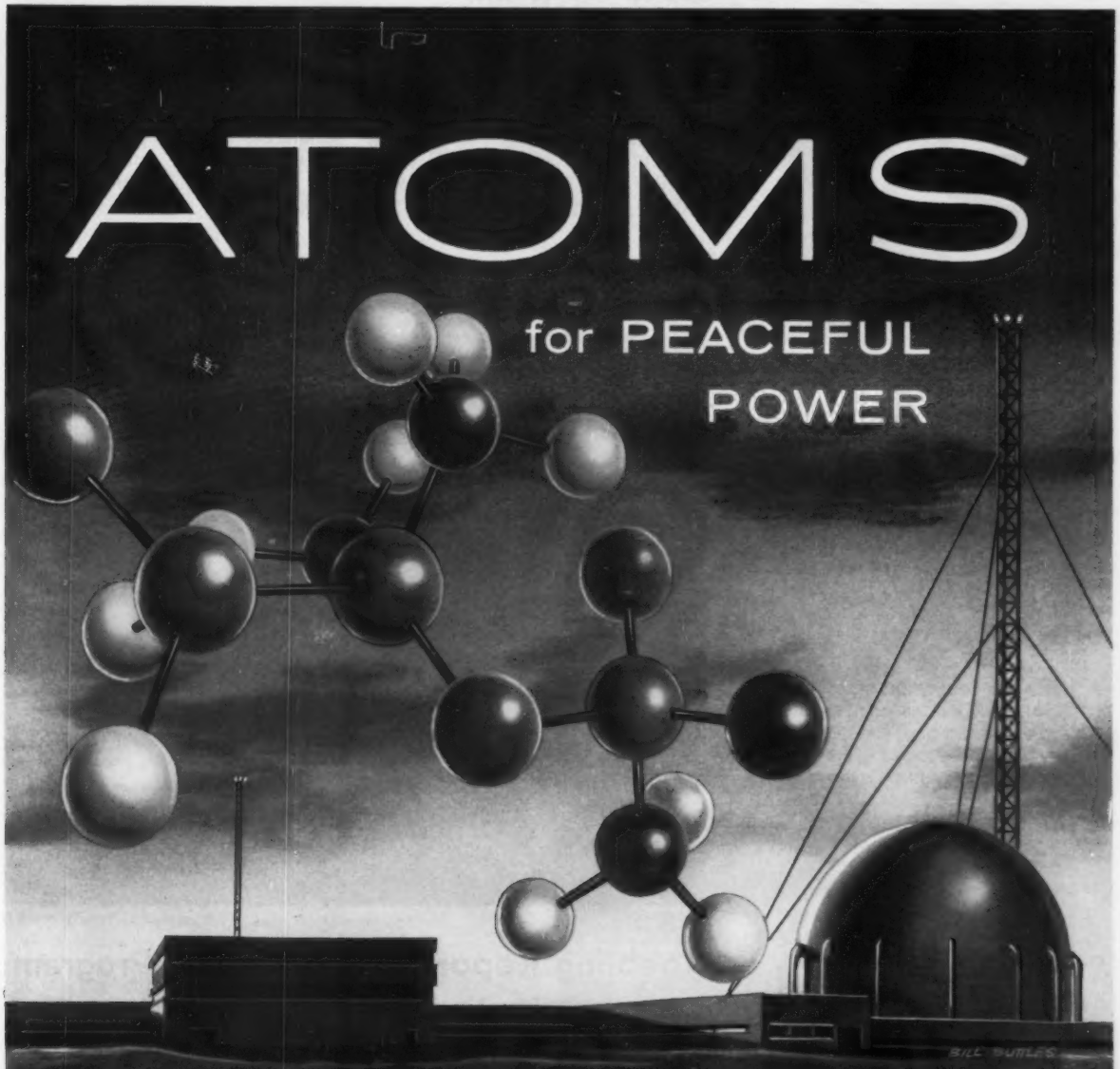
Power transformers totalled 18,948 Mva, an increase of 10,396 Mva over 8,552 Mva for 1956.

New Orders . . . For the first three months of 1957, orders were placed as follows:

Steam turbine-generators (4,000 kw and larger) totalled 2,553 Mw. Steam generators added up to a steam capactiy of 17,360,000 lb per hr. Waterwheel generators amounted to 795 Mw. Hydraulic turbines had a sum of 2,015,400 hp. Power transformers (U. S. power systems and industrials) totalled 20,254 Mva.

(*Continued on page* 198)

ATOMS for PEACEFUL POWER



FABRICATED STEEL by INGALLS

The nation's first privately financed atomic power generating station is now underway on the Hudson River at Peekskill, N.Y.

The $55 million station, being built by the Consolidated Edison Company of New York, will produce enough electricity — 236,000 kilowatts — to supply the home needs of about a million New Yorkers.

Ingalls, with years of experience in the power plant field, was selected to fabricate the structural steel and erect the $3 million plant, the largest private atomic power generating plant in the United States.

The Ingalls Iron Works Company is a specialist in steel for power plant construction having served 46 Electrical Power Companies on their major power house projects. Our long experience in the field, our modern facilities and modern methods enable us to handle any major contract with speed, economy and efficiency.

If your company is contemplating a new power house, or expansion of present plants, Ingalls offers you its services — fabricated steel, steel erection, or both.

Inquiries invited.

THE
INGALLS
INDUSTRIES
Executive Offices:
BIRMINGHAM, ALABAMA

The Ingalls Shipbuilding Corporation
Shipyards: Pascagoula, Mississippi; Decatur, Alabama
Sales Offices: New York, Chicago, Philadelphia, Washington, Houston, New Orleans, Atlanta

The Ingalls Steel Construction Company
Sales Offices: New York, Chicago, New Orleans, Pittsburgh, Houston, Atlanta

The Ingalls Iron Works Company
Sales Offices: New York, Pittsburgh, Chicago, Houston, New Orleans, Atlanta

Birmingham Tank Company
Sales Offices: New York, Pittsburgh, Chicago, Houston, Atlanta, New Orleans, Pascagoula

H. ZINDER
& ASSOCIATES
TAKES PLEASURE
IN ANNOUNCING
THE ASSOCIATION OF
MR. WILLIAM W.
ARNETT
WITH THE FIRM

AND THE FORMATION OF A COMPLETELY INTEGRATED SERVICE TO RURAL ELECTRIFICATION SYSTEMS IN SYSTEM ENGINEERING, POWER SUPPLY, RESALE RATES, FINANCIAL AND MANAGEMENT MATTERS.

H. ZINDER
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CONSULTANTS TO: ELECTRIC UTILITIES • NATURAL GAS AND OIL PRODUCTION COMPANIES • GAS TRANSMISSION AND DISTRIBUTION COMPANIES.

NEW YORK • WASHINGTON, D. C. • HOUSTON • DALLAS • SEATTLE • WASHINGTON D. C. OFFICE - 724 NINTH ST. N. W.

Record 44,449 Mw

(*Continued from page* 196)

The EEI survey covers steam turbine-generators, steam generators, waterwheel generators, hydraulic turbines, and power transformers. Data are compiled as of April 1, 1957 and relate to shipments, scheduled production, and estimated open manufacturing capacities for 1957 through 1960. Information was furnished by 19 of the country's leading manufacturers of heavy electric power equipment. Data on steam turbine-generators are based on manufacturer's maximum rated capability and the other equipments on nameplate ratings.

Roebling Reports on Expansion Program

A $2.5 million expansion and modernization program in the Electrical Wire Division of John A. Roebling's Sons Corp, includes an addition to the cable plant, new research facilities, and several new production machines, all at the Trenton, N. J., plant. The picture above shows this program being studied and its progress noted by (left to right) W. C. Ridge, works manager; F. A. French, Chief plant engineer; C. R. Tyson, executive vice president; and C. R. Wentz, manufacturing manager, Electric Wire Division.

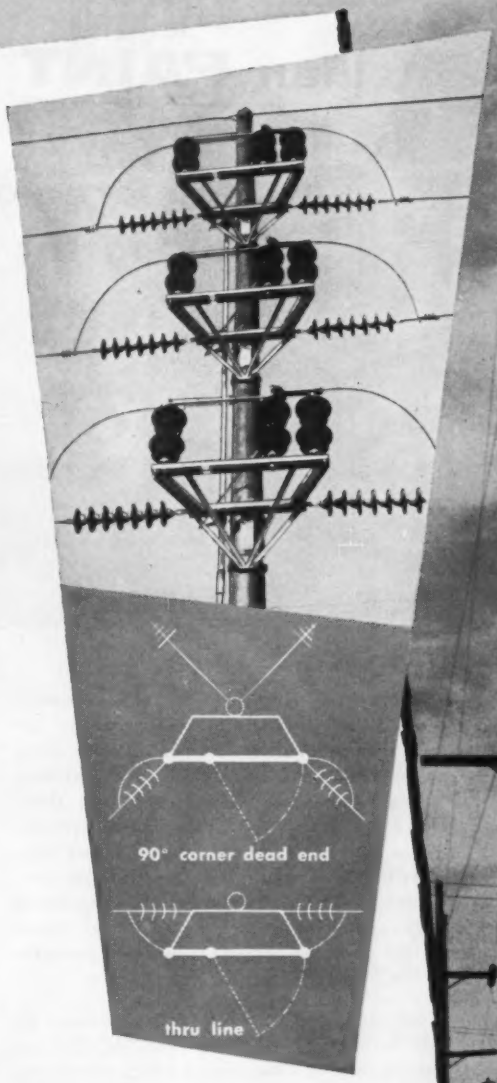
One of the major items in this program is an addition to the paper power cable plant. The new building covering about 32,000 sq ft is almost completed. Here is being installed a new and larger cabling machine with three or four main bobbins, also specializing equipment for vulcanizing neoprene protective jackets over lead sheath power cable.

A vertical continuous vulcanizer is a new design with rubber extrusion being made downward. It is used in production of high voltage cables.

Roebling already has completed extensive new laboratory and research facilities for the specific use of its Electrical Wire Division, including cyclic testing acid corona testing equipment; installed two new continuous lead presses, a new paper-taping machine for high-voltage cable, new rubber and plastic extruding equipment; and has modernized a three-roll calender.

(*More M & M on page* 200)

SAVE UP TO 35% ON INSTALLATION COSTS WITH SINGLE POLE MOUNTED TECO AIR BREAK SWITCHES...



If you use conventional air break switches that require 2 or more poles...you can save up to 35% on your present labor, material and space costs with TECO air break switches mounted on a single pole. Additional savings in line crew time are made possible with pole band mounting.

Experience with TECO switches by leading utilities not only confirm these savings, but prove that single pole installations are adequate...even in hurricane areas, where wind conditions are severest.

New TECO compact design makes possible secure single pole mounting. How compact? On the 69 KV model, distance from blade to pole is less than 36″...on the 115 KV, less than 48″.

Not top heavy. Lighter, more compact TECO air break switches stay on single poles in high winds because their weight is evenly distributed...there's no "top heaviness". No side guying necessary.

Top Performance. While cumbersome nonessentials were eliminated in the interest of better design, it was not at the expense of top performance. Examine a TECO air break switch and you'll recognize at once quality workmanship and materials. All current carrying parts are copper and beryllium copper for highest conductivity.

Available switch sizes are—15 KV thru 161 KV at 600 amps.

For more information on single pole mounted TECO air break switches that enable you to save on installation costs, make maintenance easier, write TODAY for bulletin 601.

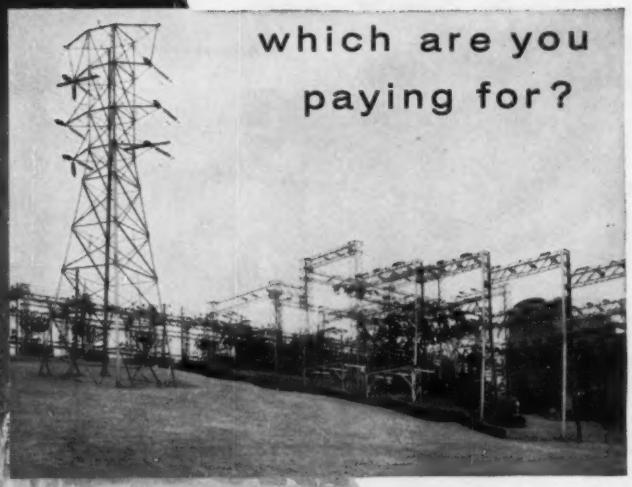
Turner Electric Corp. 9500 St. Clair Avenue
East St. Louis, Illinois

Patent number 2779830

Savings in real estate make TECO switches especially suited for use in suburban areas

CORROSION...

always costs more than **PAINT**



Corrosion always costs much more than would the necessary amount of paint to prevent it. Now, more than ever, you can realize tremendous savings in corrosion control with Sipes Tower Finish Gray No. 280, a new one-coat corrosion resistant paint for transmission towers, sub-station structural steel, woven wire fencing and other similar exterior metal surfaces. Tower Finish Gray No. 280 is a full-bodied, rust-resisting coating formulated specifically to render long and durable performance at little more than half the cost of comparable competitive finishes. Exhaustive laboratory tests and actual field tests indicate that it will out-perform competitive products costing ALMOST TWICE AS MUCH.

Eliminate your cost on corrosion — minimize your costs on its prevention. Specify Sipes Tower Finish Gray No. 280 for your next maintenance project. Compare its performance and cost with what you are using today. You'll be convinced . . . paint costs far less than corrosion.

WRITE FOR SIPES TOWER GRAY BULLETIN TG 280

SIPES
Reg. U. S. Pat. Off.

JAMES B. SIPE AND COMPANY
INDUSTRIAL DIVISION
PITTSBURGH 16, PENNSYLVANIA

Ampere Industries Makes Radiant Heating Equipment

Ampere Industries has been established at 60 Boston St, Newark 3, N. Y., to manufacture electric radiant heating equipment for residential, commercial and industrial applications. Lester H. Mantell is president. He was formerly executive vice president and general sales manager, of Electriglass Corp, Bergenfield, N. J.

Products include an all-radiant heating line of three base boards of 600, 1000, 1500 watts, a portable unit, and a ceiling heat-light unit. This equipment utilizes a new development known as the Amp-Quartz element, made of fused raw materials and claimed to be highly transparent to infra-red rays. Applications include outdoor areas like loading platforms, work areas, and under theatre marquees.

L-M Production Underway in New West Coast Plant

A 10-kva distribution transformer heralded the first production of Round-Wound distribution transformers in Line Material's new West Coast plant, Visalia, Calif. At brief ceremonies marking the occasion, Factory Manager Wayne Shelly turned the first unit over to Marketing Supervisor Lloyd Johnson for shipment.

Completion of first production units climaxed nearly eight months of coordinated efforts. Ground was broken on the 20-acre site for the new $1.25 million plant last November. During construction of the 65,000 sq ft building, local residents were trained for production positions.

Burndy Finds Connectors Stable Also on AAAC

Compression tap and service connectors originally developed for aluminum and ACSR also make stable connections with the all aluminum-alloy conductor-AAAC. This fact, according to Burndy Corp, Norwalk, Conn., is based on a series of recently completed tests.

Heat-cycle tests were made with

(*Continued on page* 202)

Point horn, pull trigger, fire's out! That's all it takes to knock out deadly fire with instant-action Kidde dry chemical portable extinguishers! So easy to use, even inexperienced operators get perfect fire-fighting results. Kidde's patented diffuser horn spreads dry chemical powder over wider area for greater fire-killing power. Trigger-release means faster action, feels more natural in the hand. Pick the Kidde dry chemical portable to fit your needs: 5, 10 lb. pressurized (recharged at any commercial air pump), 20, 30 lb. cartridge operated. For more information on dry chemical, carbon dioxide and wet chemical extinguishers, write today for Kidde's P-8 catalog and name of nearest distributor.

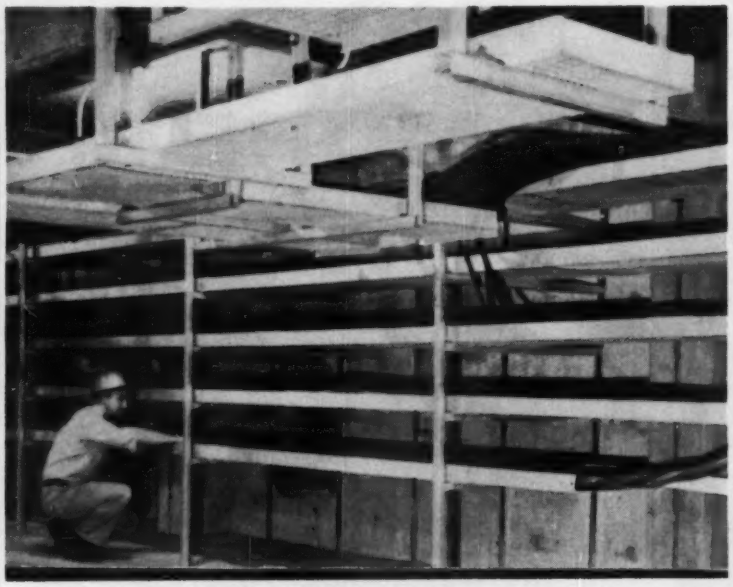
Kidde (K Kidde)

Walter Kidde & Company, Inc., 630 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

SUPPORTS FOR CABLE AND TUBING PASS "THE ACID TEST"—

THE APPROVAL OF DESIGNERS, CUSTOMERS, AND USERS WHO SAY: "Well laid out and engineered." "Nicer and sturdier." "Quick and easy to install." "Boy, does that ladder look good!" "We're ordering more." "For my money, I'll take P-W Supports anytime." "Thanks, for good delivery."



P-W offers the latest in support systems—expanded metal, ladder, or solid—which are interchangeable as required. Comes in 3", 6", 9", 12", 18", and 24" widths, in 1' multiples from 1' to 10', 12' and 16' lengths. Can be purchased in two ways: (1) in certain standard lengths, or (2) in various lengths, which, together with P-W's Extension Connectors, eliminate all field cutting. Adjustable Horizontal and Riser Connectors give the greatest flexibility and meet all changes in direction and elevation. P-W's Channel Connectors, with drive rivets, provide not only a quick connection but good electrical continuity.

Our pre-cut system provides the greatest savings in material and installation time—waste is eliminated and the various parts assembled without field cutting. Send us your drawings and we will take off bill of material. When order is placed, we mark up drawings or reproducibles with catalog numbers. Same numbers are placed on items at time of shipment to facilitate field erection. P-W Twist-Rack is available to support trough or ladder.

Join our ever-growing list of outstanding and satisfied customers. The first step is to write today for our catalogs. Let our engineers help you!

P-W INDUSTRIES, INC. Duncan & Melrose Sts., Philadelphia 24, Pa.

Representatives throughout country to serve you!

Burndy Connectors

(*Continued from page* 200)

standard Crimpit tap connectors and Linkit service connectors on the new AAAC. Relative conductivities reportedly remained stable at above 100% after repeated cycling in tests similar to those given the connectors during initial development on conductors then in use.

M & M BRIEFS

General Cable Corp, New York, reports it has adopted a 6-in. non-returnable plastic spool, weighing only 6.5 oz, for shipping enamel wire in the finer sizes. A 4.5-in. and 3-in. non-returnable plastic spool is said to be ready in the near future.

Arvin Industries, Inc, Columbus, Ind., is having constructed a 30,000-sq ft warehouse for its electronics and appliance division.

International Harvester Co, Chicago, advises that its truck domestic sales volume for April reached nearly $53 million. This is said to be the highest monthly figure for IH motor truck division.

Cutler-Hammer broke ground recently for a $4 million industrial plant on a 70-acre plot near Lincoln, Illinois.

Scovill Manufacturing Co, Waterbury, Conn., a 155-year-old brass producer, will erect a tube mill at New Milford, Conn., on a 72-acre site, the mill will have about 275,000 sq ft, being about 1,150 ft long. As a symbol of the Brass Industry, Wm. M. Goss, president, laid a brass cornerstone holding a 16 in. square by 3.5 in. deep brass box with significant items for posterity.

John C. Virden Co, Cleveland, Ohio, a manufacturer of commercial, industrial and residential lighting fixtures has formed a Marketing Dept. Appointments are: Robert W. Minett, Jr, director of marketing; C. L. Smythe, merchandising manager; Alex E. Masterton, advertising Manager; E. A. Pacius, service and credit manager.

RELENTLESS VIBRATION

Another reason why Automatic Switch chooses K&M MOUNTING PANELS

The photo above, typifying severe vibration, indicates why Automatic Switch Co., Orange, N. J., uses K&M Ebonized Asbestos mounting panels for this automatic transfer switch. Its strength and stubborn resistance to shattering make it ideal for almost all panel-mounting requirements.

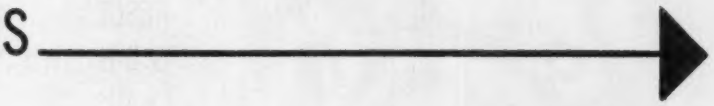
K&M Ebonized Asbestos is made of tough mineral asbestos fiber and binding cement, molded under pressure and then impregnated with insulating compound. The resulting panel material is light in weight, uniformly dependable, easy to work, economical.

You need K&M Ebonized Asbestos if you manufacture or use switchboard mountings, bus bar runs switchgear compartment linings, test tables, bench boards, or other equipment. It comes in sheets 42″ x 96″ and 48″ x 96″, ⅛″ to 4″ thick . . . also in special sizes and with beveled edges. Write us for complete details.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA
In Canada: Atlas Asbestos Co., Ltd.
Montreal, Toronto, Winnipeg, Vancouver and Edmonton

Change to New **Westinghouse Mercury Lamps...** get up to **30% more light** on work areas



More Westinghouse Job-Tailored Mercury Lamps are in use today than all other brands combined

Not only does Westinghouse make and sell more kinds and types of Mercury Lamps than anyone else, their pioneering leadership pays off in *substantial installation and operating economies.*

Westinghouse Mercury Lamps give *more light when new . . . more light for a longer life.* This means maintenance and replacement costs are reduced without sacrificing vitally needed light levels and efficiency standards.

Basic construction advances are another reason why you should specify Westinghouse for plant and factory lighting. For instance:

- Thorium-coated electrodes provide HIGHER LIGHT OUTPUT
- Molybdenum Ribbon Seal assures GREATER DEPENDABILITY, LONGER LIFE
- Hi-Temp Life-Time Bases eliminate INSTALLATION AND SERVICE BREAKAGE

Get the full story from a trained lighting expert who understands your problems. Write, wire or call your Westinghouse Lamp Distributor or the Westinghouse Lamp Division, Bloomfield, New Jersey.

More light for your money... indoors and out...
with Westinghouse Job-Tailored Mercury Lamps

YOU CAN BE SURE...IF IT'S

IMPROVED SEMI-REFLECTOR FLUORESCENT-MERCURY LAMPS D-H12-WD AND D-H15-WD (1000 watts, 220-460 volts)

Now get *up to 30% more light* in dusty areas merely by changing to the new, improved Westinghouse Semi-Reflector Fluorescent-Mercury Lamps.

Every Westinghouse D-H12-WD and D-H15-WD Mercury Lamp has a sealed-in phosphor coated reflector that directs the light downward . . . where it is needed!

Light output remains higher because dust, dirt and grime cannot impair the efficiency of the sealed-in reflector. Costly reflector cleaning operations are eliminated.

The phosphor coating provides golden white color-corrected light for truer color rendition.

In addition, famous Westinghouse Weather Duty™ construction using special glass prevents damage from condensation, water or industrial fumes.

Westinghouse

1945

THE FIRST . . . **FISHER-PIERCE PHOTOELECTRIC LIGHTING CONTROL**

. . . THE LATEST

1957

The year World War II ended, The Fisher-Pierce Company began work with utility engineers to develop photoelectric controls. Automatic, dependable switching of street lighting circuits when illumination was needed, regardless of time of day, season or weather, was the fundamental idea. The Series 61300 was the first of five different, major groups of F-P controls that have followed.

The experience has proved valuable to Fisher-Pierce and customers alike. Backed by an organization of more than 650 people, F-P today offers photoelectric lighting controls for all purposes . . . extensive sales and engineering services . . . research, development and production facilities to solve specific photoelectric/electronic equipment problems you may have. Your inquiry about F-P products, who uses them, and how you may use our development facilities for your own electronic equipment requirements, is welcomed.

THE FISHER-PIERCE CO., INC.

82 PEARL STREET, BOSTON 85, MASSACHUSETTS

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JUNE 24, 1957

The outlook for appliance manufacturers should improve as summer wears on. Up till now, they have been passing through a bleak period. Facing high dealer stocks, manufacturers have cut production in an attempt to bring unwieldy inventories into line. The job should be just about finished if retail sales have been as good as reported. But it's been a trying period.

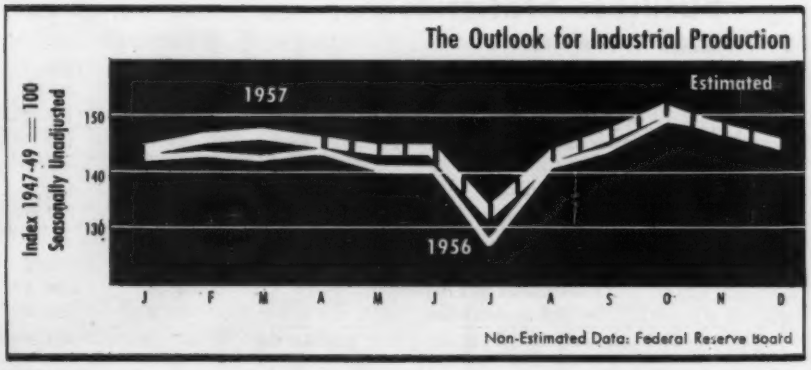
Appliance manufacturers took another beating in March. Shipments ebbed to one of the lowest levels in 13 months—hitting only 83% of the '47-'49 average. Lowest point in this period was November when the National Electrical Manufacturers Assn's index dropped to 81. But because of normal seasonal variation, this produced a comparative drop of only 8%. This March, the appliance sales index shows a 25.2% dip from March of 1956. The index has been dropping steadily since April of 1956—with exception of last July when sales rallied to score a 13.3% gain. But the latest March figure reveals appliance shipments suffered their worst jolt in a year.

Here's the picture for the first four months of 1957, *vs.* same period last year (all are estimates): refrigerators, down 13%; food freezers, down 13%; standard ranges, down 26%; built-in ranges, up 12%; water heaters, down 19%; dishwashers, down 12%; food disposers, down 20%; vacuum cleaners, down 12%; washers, down 23%; dryers, down 26%; and ironers, down 22%.

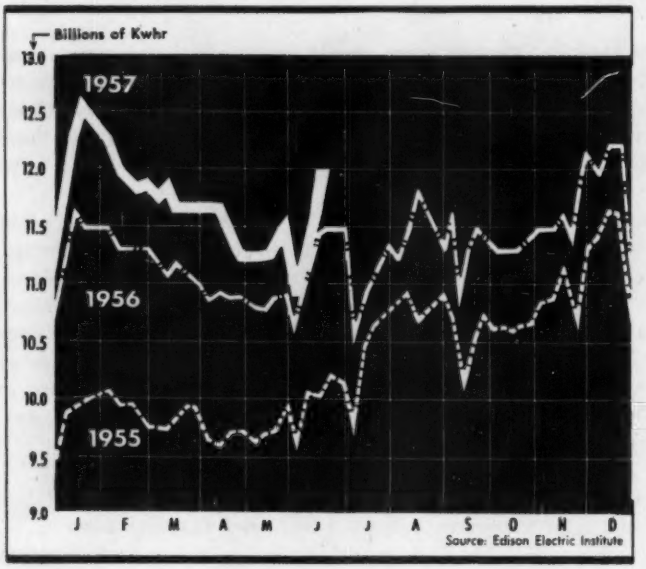
But watch for a reversal in inventory policy in the months ahead. So far this year, business has been working hard to get stocks down. This is a sharp contrast to the buildup in 1955 and 1956. At the end of last year, firms were adding to inventory at an annual rate of $4 billion. In the first three months of 1957, there was a net reduction of about $1 billion—even in the face of rising sales.

Manufacturing and trade inventories totaled $90.1 billion at the end of April. This was $4.4 billion higher than a year ago and up $150 million from March. But seasonally adjusted figures show little change. Most of the monthly increase was due to higher replacement costs, not physical gains.

Overall business right now is still that "rolling readjustment at a high level." Retail sales for May hit a modest record of $16.9 billion, while manufacturing sales tapered off a bit. Employment for May was up to a record 62.2 million, but factory employment dipped for the fifth straight month. In short, there are still mixed trends and no real reason for a spurt in inventory buying.



STATISTICS



OUTPUT

Week ended June 15,
11,958,000,000 Kwhr
Up 4.7%

Per Cent Change From Previous Year

	June 1	June 8	June 15
Total U. S.	+3.4	+ 5.5	+4.7
New Eng.	+2.6	+ 3.9	+4.0
Mid. Atlan.	+1.5	+ 3.5	+3.3
Cent. Ind.	+1.8	+ 4.4	+1.2
West Cent.	+3.4	+ 6.5	+2.4
Southeast	+6.0	+ 8.9	+8.1
South Cent.	+0.4	+ 1.5	+9.3
Rocky Mount.	—0.6	+ 3.3	+1.5
Pacific			
NW	+5.7	+ 3.7	+6.8
SW	+6.1	+10.2	+6.3

Seasonally Adjusted Index 231.3
Week Ago 226.6
Year Ago 221.6

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 4.9%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	April	122.27	121.78	116.78	4.7
Peak—Class 1 Systems (million kw)	Mar.	98.0	98.8	92.7	5.7
Estimated Dec. '57 Peak (million kw)	Mar.	113.5	113.5	114.1	— 0.5
Production—billion kwhr	April	50.67	52.45	47.49	6.7
Hydro		12.05	11.44	11.55	4.3
Fuel		38.62	41.01	35.94	7.5
Sales—billion kwhr	Mar.	47.75	47.78	45.36	5.3
Residential		13.47	14.25	12.46	8.1
Commercial		7.35	7.49	6.84	7.5
Industrial		24.44	23.65	23.70	3.1
Other		2.49	2.40	2.35	6.0
Fuel Consumption	April				
Coal—million tons		12.50	13.84	11.95	4.6
Oil—million barrels		6.47	6.57	5.76	12.3
Gas—billion cu ft		98.80	93.15	89.72	10.1
Net Income Class A & B Co's—$ million	Mar.	126.81	142.34	116.86	8.5
Residential Customers—millions	12 mos.	45.99	45.92	44.67	3.0
Revenue per kwhr	ended	2.59¢	2.59¢	2.63¢	— 1.5
Avg kwhr per customer	Mar. 31	3,021	3,004	2,820	7.1
Avg annual bill		$78.23	$77.80	$74.17	5.5

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	May	143	144	141	1.4
ENR Construction Cost	June	151.2	150	145.1	4.2
BLS Cost-of-living	April	119.3	118.9	114.9	3.8
New Orders for Machinery (1950 = 100)	April	147	159	149	— 1.3
NEMA Sales					
Insulation materials	April	145	153	163	—11.0
Electric appliances		83	97	111	—25.2
Wholesale prices	Mar.				
Motors and generators		140.7	140.2	126.9	10.9
Transformers and regulators		147.4	146.6	133.1	10.7
Switchgear and fuses		164.4	164.4	147.8	11.2
GNP—annual rate—$ billion	1st Qtr.	427.0	423.8	403.4	5.9%

MANAGEMENT BULLETIN

FINANCE

Because of "unsettled bond and money market conditions", Public Service Electric & Gas Co announced last week that it was discontinuing current negotiations for the sale of 250,000 shares of $100 par preferred stock on June 19 to be offered through underwriters led by Merrill Lynch, Pierce, Fenner & Beane. The company filed a delaying amendment to the registration statement. . .Later Gulf States Utilities Co accepted a bid of $37.88 a share for 200,000 common shares from a group of underwriters headed by Stone & Webster Securities Corp. This group reoffered the stock at $39.25 a share.

Private Sales: Cape & Vineyard Electric Co sells privately $3.5 million 4.90% notes due 1987 at par.

New issues expected to come to the market soon are: $30 million Washington Water Power Co first mtg bonds to be offered through an underwriting syndicate headed by Kidder, Peabody & Co about mid-July . . . 60,000 shares Indianapolis Power & Light $100 par preferred stock will be sold competitively.

Stockholder Subscriptions: Florida Power Corp's stockholders subscribed for 250,185 of the 255,813 common shares offered on a 1 for-10 basis at $51 a share. Balance of 5,628 shares taken by the underwriters.

REA Financing: Johnson City, Tenn., Power Board repays REA loan of $515,000 in full . . . Tri-County Electric Assn Inc of Sundance, Wyo., asks PSC approval to sign a $300,000 mortgage note securing an REA loan.

A booklet "Financial and Statistical Review—Years 1952-1956 Inclusive" has just been released by the Pacific Gas & Electric Co. It has been prepared primarily for institutional investors and security analysts. For copy write K. C. Christensen, treasurer, PG&E, San Francisco, Calif.

Secondary Offering: First Boston Corp and associates sell quickly 83,800 common shares Rochester Gas & Electric Corp at $28.25 a share.

REGULATION

Deferred income taxes used in setting rates attacked in California. State's Attorney General Edmund G. "Pat" Brown sends letter to PUC declaring he is opposed to commission using deferred taxes in figuring the base for rates. Writes Brown: "The benefit received by the utilities from the tax deferment granted by the federal government should be passed on to the ratepayers and not maintained in special accounts for reinvestment in capital property to the further gain of the companies themselves." In reply to Brown, PUC Pres Peter E. Mitchell points out the Southern California Edison Co case, which will form the precedent (utility asked for a ruling on the deferred tax issue) has already been taken under submission. If Brown has any arguments to present, he will have to petition for a reopening, Mitchell says.

RATES

Tennessee town reduces rates. Gallatin, Tenn., Electric Department will cut rates an estimated $38,686 a year.

LEGISLATION

California: A bill to set the price on which power produced at state water projects will be sold has been referred for interim study to the California Assembly's Conservation Planning and Public Works Committee.

Delaware: Gov J. Caleb Boggs signs bill which requires the state to pay utilities for the expense of relocating their equipment when the state uses 90-10% federal matching funds for its road-building program.

Texas: Gov Price Daniels signs bill which will permit Texas Utilities Co to pay franchise taxes on 20% of its assets which are also taxed through its subsidiary

companies. Bill replaces act which required payment to be made on 100% of the asssets in both the holding and operating companies.

FUEL COSTS

Higher fuel costs is the principal reason why Los Angeles, Calif., Department of Water & Power's budget is higher in 1957, J. C. Moller, Jr, president, has revealed. He said that the increased costs of fuel oil and gas purchases needed to operate steam plants account for almost half of the budget increases, jumping from $19.5 million to $26.1 million.

EMPLOYEE RELATIONS

New labor contracts signed. Portland General Electric Co and AFL-CIO machinists, operating engineers, and building service unions agree to a 4½% wage increase, retroactive to March 1. Employees with 20 years or more service will be granted a fourth week of vacation. A similar agreement was signed May 10 with IBEW . . . Pacific Gas & Electric Co and IBEW agree to two-year contract. Clerical employees and physical workers of the union will receive a 5½% wage hike starting July 1. A second increase of 5% will be made on July 1, 1958. Pacts give employees a three-week vacation after ten years and double time and a half pay for holiday work. Ratification of the contracts is expected by the end of June . . . Toledo Edison Co and IBEW sign two-year contract with wage increases ranging from 10 to 16¢ an hour. Contracts calls for a wage reopener on June 1, 1958.

Union election scheduled at Puget Sound & Light Co. About 40 engineering employees of the company will vote in June on their choice of a bargaining agent as the result of a petition filed with the National Labor Relations Board by the Seattle Professional Engineering Employees Assn. Board, in granting the petition, excluded supervisory employees from participating in the election. Association was started about 12 years ago and is at present the certified bargaining agent for engineers at the Seattle plants of the Boeing Airplane Co and Continental Can Co.

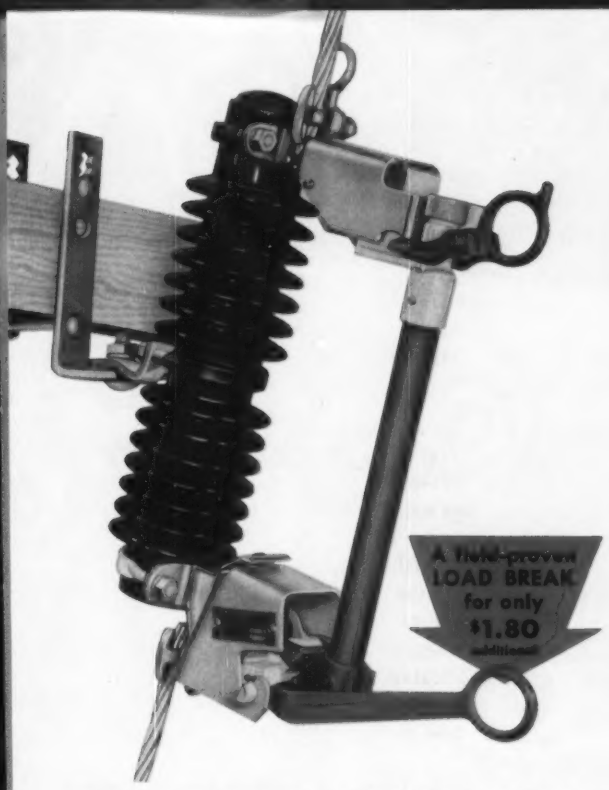
Calgary, Alberta, Electric Light & Power Department establishes an apprenticeship school by agreement with the IBEW. A joint statement said: "In the field of apprentices, agreement has been reached with the union officials for the setting up of an apprentice school. It will be under the administration of both management and labor on a co-operative basis." Earlier a strike was averted when the company and the union agreed to a two-year contract calling for nearly $300,000 in wages increases.

TAXES

Nevada county asks for taxes on Hoover Dam power facilities. District Attorney George Dickerson, Las Vegas, Nev., files $138,600 civil action against the City of Los Angeles in an attempt to force payment of taxes to Clark County for the power generating facilities at Hoover Dam. He also made demands on the California city for an additional $46,200 in taxes for the coming year, which should be paid within the next 30 days, it is contended. Tax money is sought back to June 1, 1954, based on assessments on seven generators on the Nevada bank of the Colorado River which are owned by the Los Angeles Department of Water & Power. Also named as a defendant in the suit is the Southern Nevada Power Co which the county is seeking to tax under the same ordinance.

PUBLIC RELATIONS

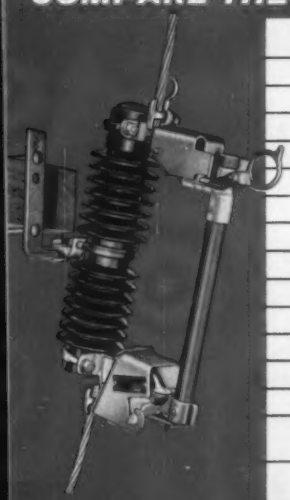
Survey favors Puget Sound Power & Light Co. Almost seven out of every ten persons single out Puget as doing the best job of any company or industry in the area, according to a survey conducted early this year by Louis Harris and associates. More than nine out of every ten persons expressed the opinion that electricity is better than gas for home use, such as cooking and water heating.



CHANCE *TYPE "F"* CUTOUTS

Here's what Utility Company Engineers say about Type F:
"It makes future system conversions simple and inexpensive... "I especially like being able to change from standard to load break... "It's ten times better than the cutouts we have been using ..."You have given us all the things we have asked for in a cutout."
But find out for yourself—compare the Type F, feature by feature, with the cutout you are using today.

COMPARE THESE 16 FEATURES



Interchangeable Fuseholders Covering Complete NEMA Range
Wrap Around Insulator Bolts for strength
Bird Proof Construction
Lift and Tie Ring
Universal Terminals–#6 Solid cu. to 3/0 ACSR
Sleet Hoods at Both Ends
Positive Guiding of Tube
Positive Latch—holds tight against surges
All Contact Surfaces Silver Plated
Self Cleaning Contacts
Lever Action When Opening
Link Ejector—aids low fault interruption
Load Break
Fuseholder Cannot be Installed Backwards
180° Stop to Prevent Fuseholder Swinging Back into Pole
NEMA Standard Mounting Bracket

DEPENDABLE INTERRUPTION.

What do you want in the CUTOUTS you buy?

TOM CURTIS, Chief Engineer, Protective Devices, A B. Chance Co., directed a nationwide survey to determine the most wanted cutout features.

Here are the features you asked for! *

* **A NATIONWIDE FIELD CHECK** of distribution engineers indicated sixteen important features that were wanted in fuse cutouts. *All sixteen* were combined into the Chance Type F Cutout—and *only* the Type F offers all these features!

Serving the Utility Industries since 1907

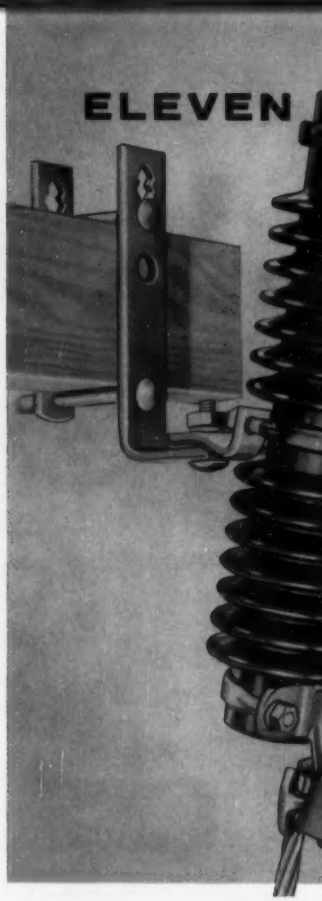
50TH ANNIVERSARY
A. B. CHANCE COMPANY

CHANCE *TYPE "F"* CUTOUTS

Here's what Utility Company Engineers say about Type F:

"It makes future system conversions simple and inexpensive... "I especially like being able to change from standard to load break... "It's ten times better than the cutouts we have been using ..."You have given us all the things we have asked for in a cutout."

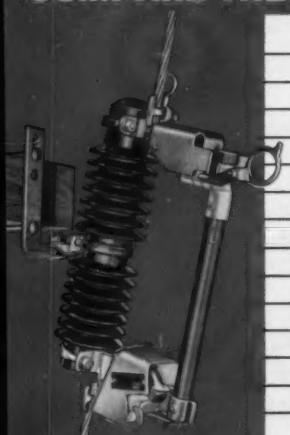
But find out for yourself—compare the Type F, feature by feature, with the cutout you are using today.



By simply changing the fuseholders can be either regular or load-brea interrupting capacities from 3,000 7.8 KV ratings and from 2,000 to

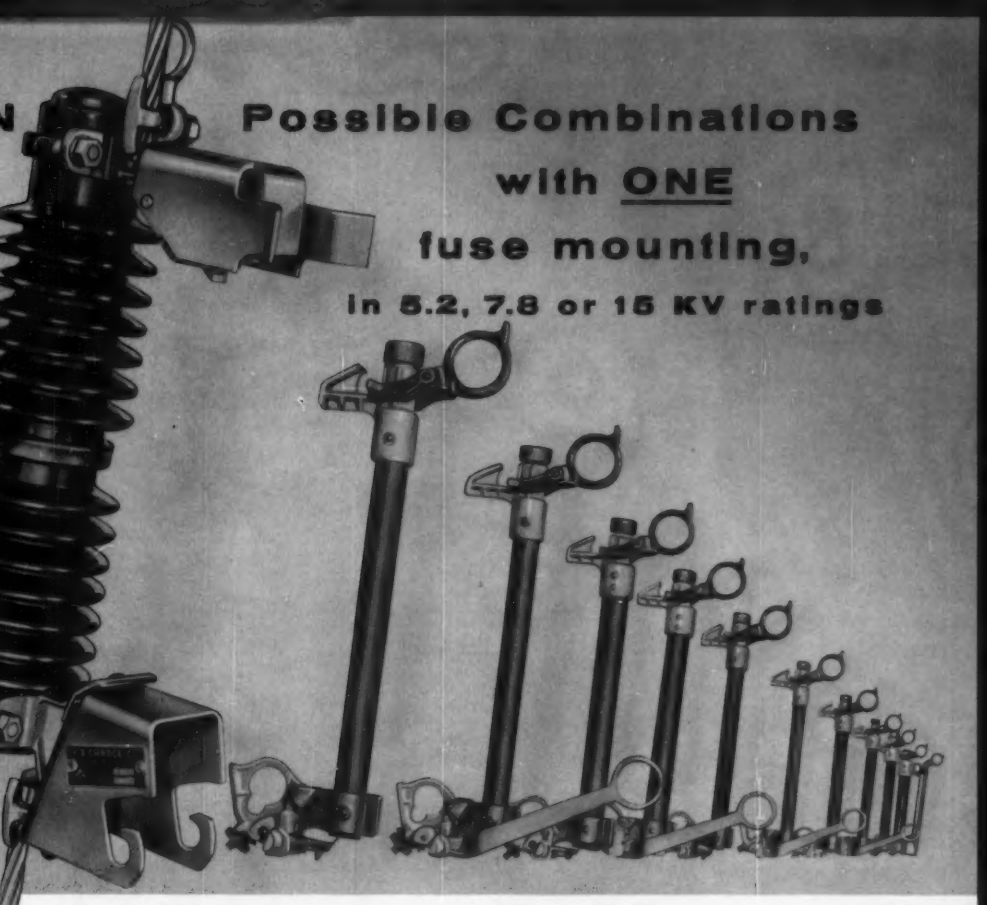
For 200 amp service you can purc or convert the 100 amp fuse mount —just remove the contacts with a them with 200 amp contacts and

COMPARE THESE 16 FEATURES



	Chance Type "F"	Cutout "G"	Cutout "H"	Cutout "I"	Cutout "J"
Interchangeable Fuseholders Covering Complete NEMA Range	YES	NO	YES	NO	NO
Wrap Around Insulator Bolts for strength	YES	YES	NO	YES	YES
Bird Proof Construction	YES	YES	YES	YES	NO
Lift and Tie Ring	YES	NO	NO	NO	NO
Universal Terminals–#6 Solid cu. to 3/0 ACSR	YES	YES	NO	YES	YES
Sleet Hoods at Both Ends	YES	YES	NO	YES	NO
Positive Guiding of Tube	YES	YES	YES	YES	NO
Positive Latch—holds tight against surges	YES	NO	NO	NO	NO
All Contact Surfaces Silver Plated	YES	YES	YES	YES	NO
Self Cleaning Contacts	YES	YES	YES	YES	YES
Lever Action When Opening	YES	NO	NO	NO	NO
Link Ejector—aids low fault interruption	YES	NO	NO	NO	NO
Load Break	YES	YES	YES	YES	YES
Fuseholder Cannot be Installed Backwards	YES	YES	NO	YES	YES
180° Stop to Prevent Fuseholder Swinging Back into Pole	YES	NO	NO	YES	YES
NEMA Standard Mounting Bracket	YES	YES	YES	YES	YES

DEPENDABLE INTERRUPTION...*on BOTH High*



Possible Combinations with ONE fuse mounting,

in 5.2, 7.8 or 15 KV ratings

olders, Chance 100 amp Type F Cutouts
-break, and can be altered to increase
3,000 to 10,000 amps in the 5.2 and
00 to 8,000 amps in the 15 KV rating.

purchase 200 amp F Cutouts complete
mounting to a 200. The change is simple
ith a screwdriver and wrench, replacing
and using 200 amp fuseholders of the

desired voltage and interrupting capacity (4,000 or 12,000 amp interrupting capacity in 5.2 and 7.8 KV... 4,000 or 10,000 amp interrupting capacity in 15 KV).

The same solid disconnect blade can be used in either the 100 or 200 amp mounting to convert to a 200 amp disconnect switch. Thus there are eleven possible combinations with one fuse mounting to meet all your future requirements. To get full details, write for the booklet "What do you want in the CUTOUTS you buy?"

	Cutout "J"	Cutout "K"	Cutout "L"	Cutout "M"	
	NO	YES	NO	NO	
	YES	NO	NO	NO	
	NO	YES	NO	YES	
	NO	NO	YES	YES	
	YES	YES	NO	NO	
	NO	NO	NO	NO	
	NO	YES	YES	YES	
	NO	NO	YES	NO	
	NO	NO	YES	YES	
	YES	NO	YES	YES	
	NO	NO	NO	NO	
	NO	NO	YES	YES	
	YES	YES	YES	NO	
	YES	YES	YES	YES	
	YES	NO	NO	YES	
	YES	YES	YES	YES	

...igh and Low Faults

CHANCE *Protectolink* OPEN LINK TYPE CUTOUTS

Protectolink Cutouts are efficent and inexpensive for wide application on rural distribution lines or where high interrupting capacity is not required. All manufacturers' open link fuses can be used in this cutout. Bird-proof construction with wrap-around mounting bolt. Available in two ratings, 7.5 and 15 KV, 50 amperes.

ECONOMY PLUS EFFICIENCY

CHANCE Fuse Links and Secondary Fuses

Engineered for system and equipment protection

for coordinated system protection

K & T FUSE LINKS

Precision manufactured to EEI-NEMA Interchangeability Standards

These fast (K) or slow (T) fuse links have the uniform quality needed for proper coordination.

Auxiliary tubes on links through 100 amps provide positive circuit interruption of low fault currents.

Low amperage links have a stainless steel ejection spring to further assure low fault current interruption.

for full overload capacity transformer protection without unnecessary outages

SloFast (Dual Element) FUSE LINKS

Follow the ASA safe loading curve for transformers

This exclusive Chance development permits full use of transformer overload capacity—virtually eliminates "burn-outs" due to overloads and secondary faults—isolates transformers in case of failure—improves continuity of service to your customers. Buttonhead and open link styles from 0.2 to 10.4 amps inclusive.

for complete secondary system fusing

Type CTSI Indicating Fuses

Here's secondary fusing that gives you protection from overload problems on your secondary systems . . . isolates failed capacitors or faulted sections—isolates transformers—localizes outages to help maintain customer service. Red plastic semaphore is released automatically when fuse element ruptures—can be easily spotted from the ground. From 5 to 200 amps inclusive. Available with insulated leads, as shown, or with bare leads.

All Chance Links and Fuses have exclusive lead-coated corrosion-resistant copper leads.

PACKAGED FOR EASY REMOVAL

Linemen can easily remove links from containers while wearing gloves. A slight firm twist separates the single container from the 5 unit container. The end of each unit container is perforated for quick removal of the link. Type and rating are clearly marked on both ends of each unit container.

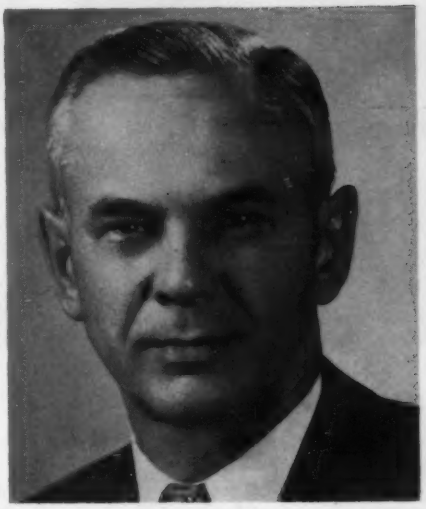
Write for our new bulletin "FUSE LINKS AND HOW TO USE THEM." Address A. B. Chance Company, Centralia, Mo.

CK57-2

A·B·CHANCE CO·

ABC INDUSTRIES

Nichols Elected Utility Head



L. A. NICHOLS

L. A. Nichols has been elected to succeed Howard J. Underhill as president of the Superior Water, Light & Power Co. Underhill, although retiring as chief executive officer, will serve as a consultant to the company and will continue as a member of its board of directors.

Nichols comes to his new position from the post of vice president and general manager, which he has occupied for the past year. A 22-year veteran with Superior, Nichols came to the company in 1935 as a sales engineer. In 1942, shortly before beginning a three-year stint with the Navy in World War II, he was advanced to general sales manager.

A 1930 graduate of George Washington University, Nichols was associated with Wisconsin Valley Electric Co and Lake Superior District Power Co before joining Superior.

S. N. FIALA

Fiala Advanced by AGE Unit

American Gas & Electric Service Corp has announced the election of S. N. Fiala as vice president and chief engineer.

Fiala, before being appointed to his new position, had served as chief engineer for AGE for three years. Since he began his association with the company in 1934 he has served in various capacities in the engineering department. He was named mechanical engineer in charge of the Mechanical Engineering Division in 1945 and became chief engineer in 1954. He received his mechanical engineering degree from Stevens Institute of Technology.

In a simultaneous promotion, Paul W. Emler was elected assistant vice president. He is former director of industrial sales for the company.

Nesbit Gets PA Post

D. E. NESBIT

Duquesne Light Co's Daniel E. Nesbit has been named general purchasing agent of the purchasing department.

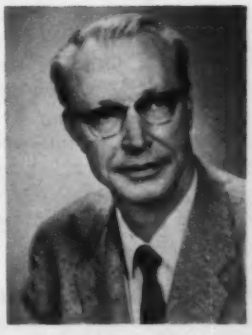
Nesbit is former purchasing agent. During his 10-year career with the utility he has also been project engineer and senior engineer.

New mechanical engineer is A. C. Stanojev, former senior mechanical engineer, Shippingport project.

Rathbun is Elevated

Western Light & Telephone Co has promoted H. V. Rathbun from general superintendent, electric department to manager of transmission, distribution.

A graduate electrical engineer of Kansas State College, Rathbun has been with WL&T for 10 years. He was formerly associated with Century Electric Co, General Electric Co, and Kansas City Power & Light.



H. V. RATHBUN

Lewis is Promoted to Executive VP

Mord Lewis is newly elected executive vice president and director of Anaconda Aluminum Co, a subsidiary of The Anaconda Co.

Lewis has been a vice president of Anaconda Aluminum since last October. He began his association with the organization 31 years ago in Anaconda Copper Mining Co's geological department.

After an absence of seven years, when he was an instructor at Harvard University Graduate School and served with Reconstruction Finance Corp and Securities Exchange Commission, he returned to Anaconda in 1939 as a mining engineer. He rose to assistant to the vice president of the parent firm in 1953 and became vice president in 1956. Lewis is a graduate of University of Virginia, where he obtained his MS degree in geology. He also holds an MS in mining engineering from Harvard.

MORD LEWIS

Federal Pacific Electric VP's Shelley

The board of directors of Federal Pacific Electric Co has announced the recent election of Leonard Shelley as vice president of the company. In his new capacity he will continue to have charge of the company's Western sales region.

Shelley has been associated with Federal Pacific since 1948, when he joined the company as Los Angeles district manager. He was promoted to manager of the Western region in 1950.

An engineering graduate of the University of Michigan, Shelley is a member of the American Institute of Electrical Engineers and Pacific Coast Electric Association.

LEONARD SHELLEY

PERSONAL BRIEFS

Rockland Light & Power Co has appointed Vice President **L. W. Merrow** to head electric and gas operations. **D. B. Seifried** was named assistant vice president of both operations.

The system project engineering department of Niagara Mohawk Power Corp has advanced **Harold I. Howell** from chief system project engineer to staff engineer and named **J. Norton Ewart** to succeed Howell. Appointed to new company positions were **Earl B. Strowger,** chief hydraulic engineer, who now becomes system project engineer in charge of hydroelectric stations, and **Franklin S. Helfter,** staff mechanical engineer, who was named system project engineer in charge of steam electric stations.

Russell G. Brown has been named Dubuque district manager of Interstate Power Co.

Roy E. Wright has been named director of gas and electric sales for the NEGEA Service Corp of New England Gas & Electric Assn. **Frederick A. Schloman** becomes assistant director of gas and electric sales.

At Carolina Power & Light Co, **M. T. Dunlap** was named industrial relations consultant and is succeeded as personnel director by **J. S. Newbold.**

Ohio Power Co has announced the following promotions: **Harry D. Markley** succeeds the late **Mark A. Rodgers** as system chief civil engineer at Canton; **Walter E. Spitzer** rises to division superintendent of electrical operations at Newark and is replaced as division distribution superintendent by **Frank M. Tedrick; Homer G. Hornung** becomes distribution engineer at Newark; and **Ronald E. Crawford** is new assistant manager of the Tidd plant. In addition, **Lewis J. Matthias** has been named personnel supervisor at the company's new Kammer plant.

Leslie Pearce has been named to succeed **John C. Maultsby** as manager of Carolina Power & Light Co's office serving the Wallace-Warsaw area. Maultsby is now local manager at Roxboro.

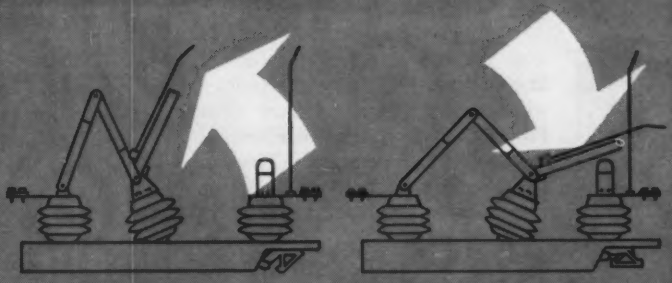
Dayton Power & Light Co has named **John McGee** assistant manager of industrial relations; **Dwight Garber** assistant to the commercial manager, and **Myron Thomas** head of the newly created continuing property records department.

Ralph M. Besse, executive vice president of Cleveland Electric Illuminating Co, recently received the honorary degree of doctor of letters of humanity at Heidelberg College.

(*More Briefs on page* 218)

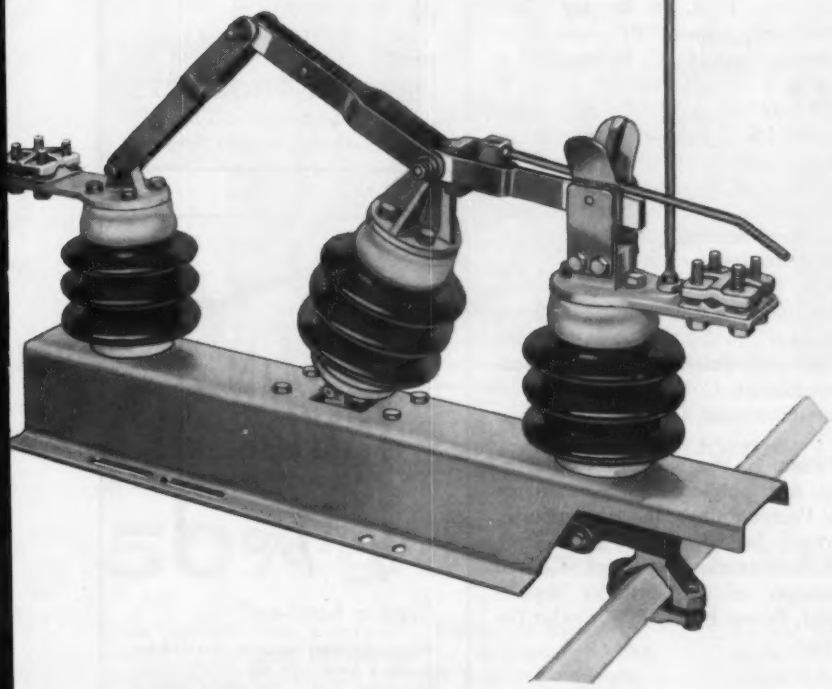
Special **KEARNEY** design for

smooth opening and closing



despite crossarm warpage

TILTING INSULATOR GANG SWITCH



- Switch works smoothly even when crossarms are warped out of alignment, horizontally or vertically, because the specially designed interphase shaft clamp compensates for any structural distortion
- Double leverage frees switch blade of heavy ice coatings: "pry-out" blade action plus toggle action of operating linkage on the tilting insulator
- Longer maintenance-free service in corrosive atmospheres—and in unusually frequent operation—because there is no flexible blade shunt to wear out
- Extra long jaws: adjustment for blade travel need not be critical . . . silver blade to jaw contacts
- Tilting insulator supported by Oilite bearings
- Easy installation . . . interphase shaft can be lifted into clamps after switch is in position

JAMES R. KEARNEY CORPORATION

General Offices: 4224-42 Clayton Ave., St. Louis 10, Mo.

-365

for BETTER CONSTRUCTION
SAFER MAINTENANCE

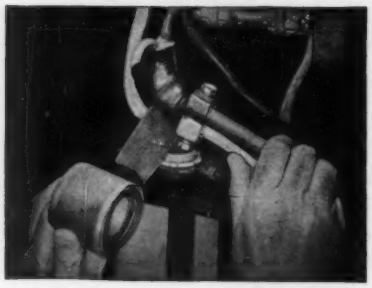
Specify JAMES R. KEARNEY CORPORATION ST. LOUIS MO. GUELPH, ONT. *The Mark of Quality*

KEARNEY PRODUCTS

Plants at: ST. LOUIS · FAYETTEVILLE, ARKANSAS · SHENANDOAH & CLARINDA, IOWA — GUELPH, ONTARIO, CANADA

Volseal...

the new high dielectric putty...



makes sealing easier!

New Johns-Manville Volseal is a high dielectric putty designed for sealing heavy cables and irregularly shaped objects. It has a dielectric of 445 vpm, together with excellent physical properties. Resists acids and alkalis, weathers well, is highly resistant to water, does not corrode metals.

Volseal also offers easy application. It is highly elastic, provides good adhesion, hardens within 3 hours on air curing. Available in extruded beads, ribbons and pugs. For complete details on Volseal and its new companion product Napseal, the petroleum resistant sealing compound, write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

Johns-Manville
SEALING COMPOUNDS

Personal Briefs

(*Continued from page* 216)

The recently created Washington State Power Advisory Committee, which replaces the former State Power Commission, has reached full strength of five members. They are **Dean Barline,** Tacoma utilities director; **George Brunzell,** official of Washington Water Power Co; **Shirley Marsh** of Longview; **Victor A. McMullen** of Wenatches; and **Ernest Miller** of Cle Elum.

H. Baldwin is newly appointed sales manager of Clifton Conduit Corp . . . Radio Corp of America recently designated **Theodore A. Smith** executive vice president of industrial electronic products.

New manager of Westinghouse Electric Corp's metals plant at Blairsville, Pa., is **R. D. Rowley.** The plant will have as its manager of alloy products **E. C. Bishop** and as manager of fuel products **J. Q. A. McClure** . . . The company has elevated **S. F. Johnson** from Atlantic region sales promotion manager to manager of apparatus and defense advertising . . . **E. W. Seay** has been appointed manager of general advertising for the company.

Ronald E. Brandon was recently appointed to the new post of turbine steam path design engineer for General Electric Co's Large Steam Turbine-Generator Department.

William H. Wagner is new advertising and public relations manager for Pacific Pumps, Inc, a member of Dresser Industries . . . Blaw-Knox Co recently named **George M. Keen** manager of the sprinkler department, Power Piping & Sprinkler Division.

OBITUARY

Maurice J. McCarthy, Jr, 50, commercial vice president of Anaconda Wire & Cable Co, died recently after a short illness.

Edward D. Stryker, 64, manager of utility sales for General Electric Co's large lamp department, died suddenly in Washington, D. C.

PREMAX

METAL MARKERS

NEED NO MAINTENANCE AFTER INSTALLATION

Find out about all the features of economy, long wear and clear legibility that Premax offers in stamped and embossed tags, letters and figures of aluminum or brass. Ask your jobber, or write Premax direct.

Premax Metal Markers are R.E.A. Approved.

PREMAX PRODUCTS
Div. Chisholm-Ryder Co., Inc.
5748 Highland Ave., Niagara Falls, N. Y.

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When the next rung on the ladder seems a long way off—that's when Electrical World can really lend a hand. Keeps you advised of the latest technical developments, in touch with fast-breaking industry news, alert to possible future developments, keeps you abreast of industry statistics, legislation, industrial relations—Only "The Electrical Industry's Weekly Magazine" can keep you really *on top of every industry occurrence of importance!*

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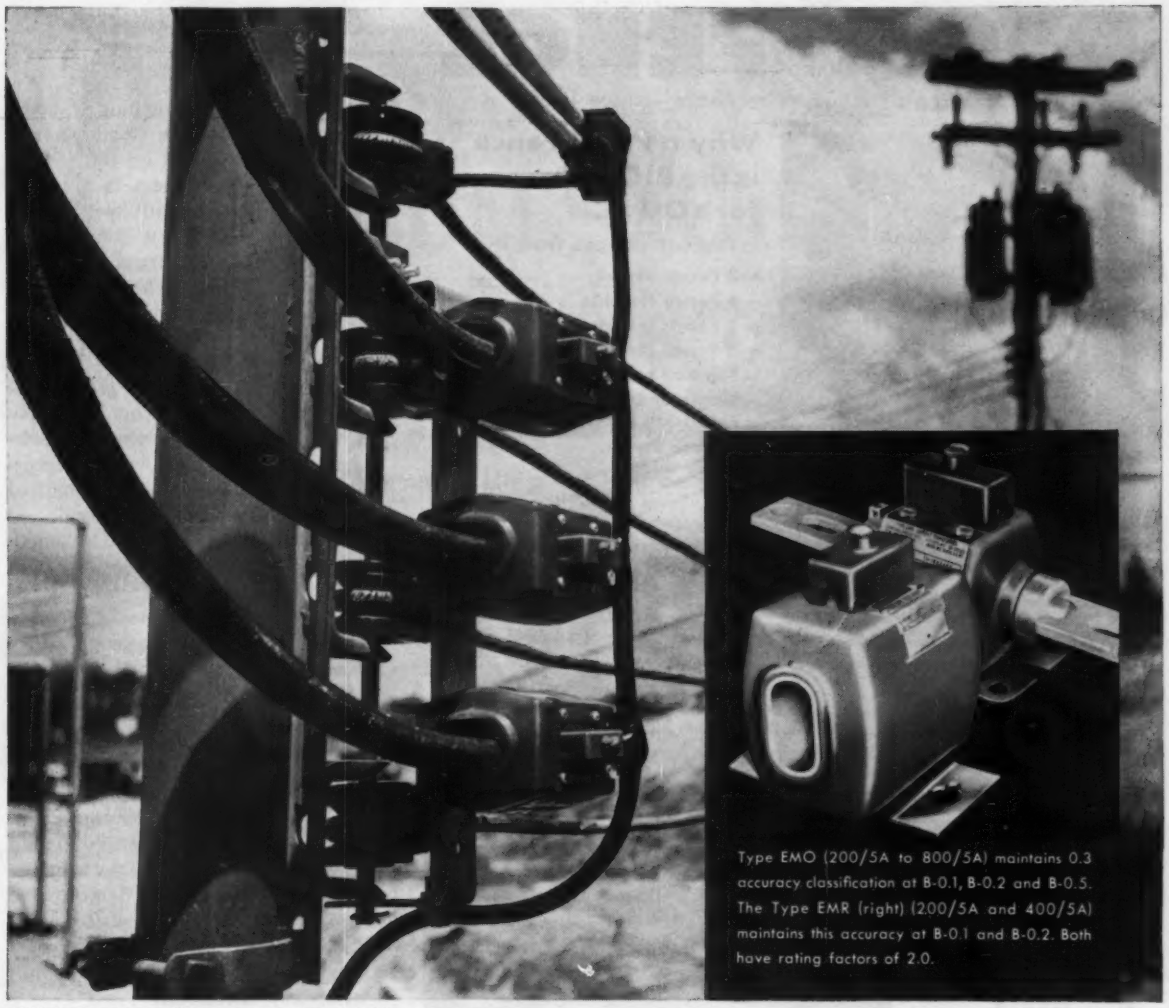

Type EMO (200/5A to 800/5A) maintains 0.3 accuracy classification at B-0.1, B-0.2 and B-0.5. The Type EMR (right) (200/5A and 400/5A) maintains this accuracy at B-0.1 and B-0.2. Both have rating factors of 2.0.

EMO's mounted on TMB-3 Brackets (Patent Pending). Brackets manufactured by B & C Metal Stamping Co., Atlanta, Georgia.

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50% greater cable capacity

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2. **Positive, Permanent Cable Connections**—exclusive Ilsco-type secondary terminals (Underwriters' listed) with weatherproof covers provide more positive, permanent connections.
3. **Longer Life**—polyester molding gives outstanding protection against weather, and corrosive acid or alkali fumes. *These transformers are ideal for either indoor or outdoor installation.*
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5. **Unexcelled Thermal and Dielectric Stability**—physical flexibility is maintained at high and low temperatures.

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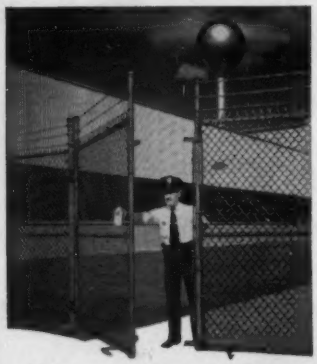

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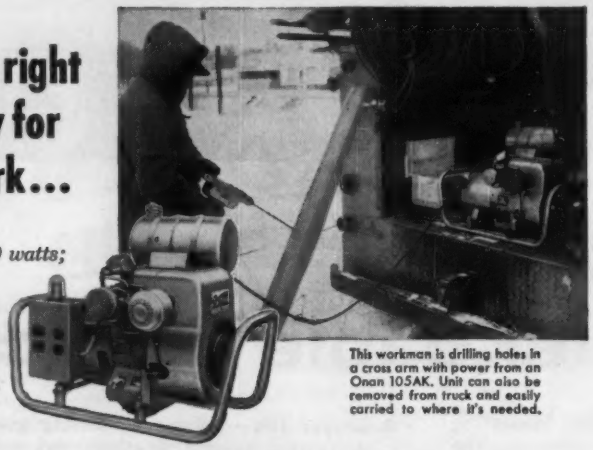
develops 1500 watts; weighs only 125 pounds; 4-cycle engine power



This workman is drilling holes in a cross arm with power from an Onan 105AK. Unit can also be removed from truck and easily carried to where it's needed.

Onan Model 105AK-1P Electric Plant

This power-packed lightweight plant supplies all the power you need for electric drills, saws and other equipment... and for floodlighting on night jobs, too!

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Lightning Arresters

(*Continued from page* 93)

Large 120-kv switching stations, serving generally as stepdown stations, have arresters on the 120-kv lines and transformers in a layout similar to power plant switchyards. A 120-kv step-down station with 24- or 40-kv subtransmission is shown in Fig 5. The entire subtransmission system was 24 kv until lack of capacity in the outlying areas prompted an increase to 41.7 kv.

This nominal 40-kv system is shown as part of the outgoing subtransmission. At the time the voltage was increased, many transformers in distribution stations had 24-kv class insulation connected delta-delta 24/4.8 kv. The maximum unfaulted phase-to-ground voltage was estimated at about 30 kv for the well-grounded 40-kv system. For this case nothing smaller than a 30-kv arrester would do.

There was speculation as to whether the economical 30-kv line-type arrester would protect old 24-kv class transformers. However, because the cost of replacing all these transformers with new units insulated for 34.5 or 46-kv would have been prohibitive, the connection was changed from delta to wye and 30-kv line-type arresters were used. Experience over 15 years shows that the application has been extremely successful.

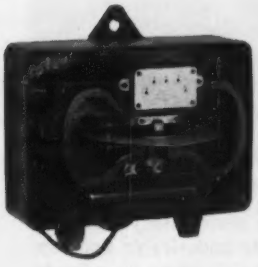
As the 40-kv system expanded, analysis disclosed that grounding efficiency had changed from "effective" to "non-effective," at some locations with the maximum sound-phase-to-earth voltage about 33 kv. Because additional points to ground the system effectively would upset relay coordination, a small probability of arrester failure was accepted. After more than 2,500 arrester years of operation, no arrester failures have been attributed to excess power voltage.

Protection of a typical 24/40-kv wye-4.8 kv delta distribution station is shown in Fig 6. In this suburban type station, served by overhead lines and with overhead outgoing feeders, distribution-type arresters are used on the outgoing lines to protect line regulators and step-down transformer secondaries. The supply side is protected with

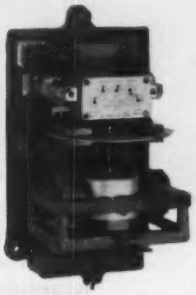
(*Continued on page* 222)

Do you have "MUSEUM" METERS on your system?

The meters shown are from Sangamo's Museum of Metering.



STANLEY A. C. WATTHOUR METER—1902. First meter to utilize principle of magnetic suspension. Sold for $10.00



THOMPSON A. C. WATTHOUR METER—1898. First induction type meter manufactured by Thompson which superseded his commutator type meter. Sold for $14.00

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More than 15,000,000 meters now in service are obsolete*

Surveys indicate that in addition to the millions of totally inadequate 5 amp. 2-wire meters still in service, there are another 11,000,000 meters of the "doubtful" category on utility company lines.

These "museum" meters are spinning at top speed in a hopeless effort to keep on measuring today's residential loads.

Carefully planned meter retirement programs are the wise answer to the problem. And the wise investment in replacement meters is the Sangamo J2—the watthour meter built to handle today's loads . . . *and* the loads of the future.

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*These figures are based on surveys published in Electrical World. "LOADS OF THE FUTURE AND METERS OF THE PAST" has been reprinted for your convenience by Sangamo. Drop a postcard or a note for your copy of these surveys.

JM 57-4

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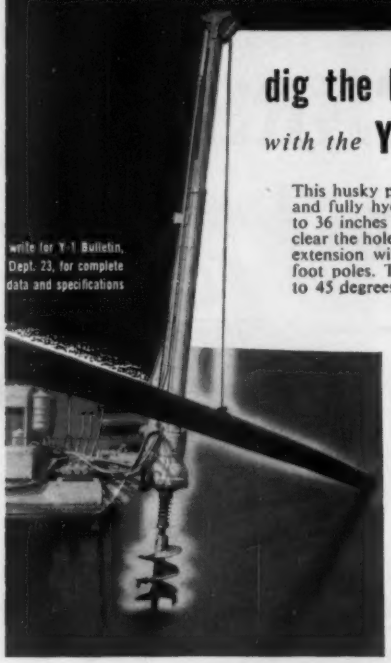

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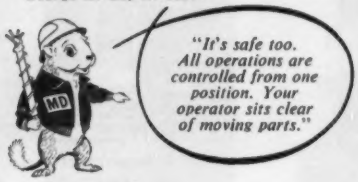

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Lightning Arresters

(*Continued from page* 220)

line-type arresters.

Distribution stations in urban areas may have more transformers, more buses, and more feeders per bus, but the basic arrester protection is the same as for smaller suburban stations. In (A) of Fig 6 both sub-transission supply and outgoing feeders have entrance cables. Cable junction arresters are considered necessary for pothead protection but are not considered when specifying station arresters. The open-wire version (B) also shows an air-break line-sectionalizing switch. All such switches on subtransmission are protected by arresters on the switch or not farther than one span away. Voltage regulators are protected on the outgoing feeder side.

Reliable Power

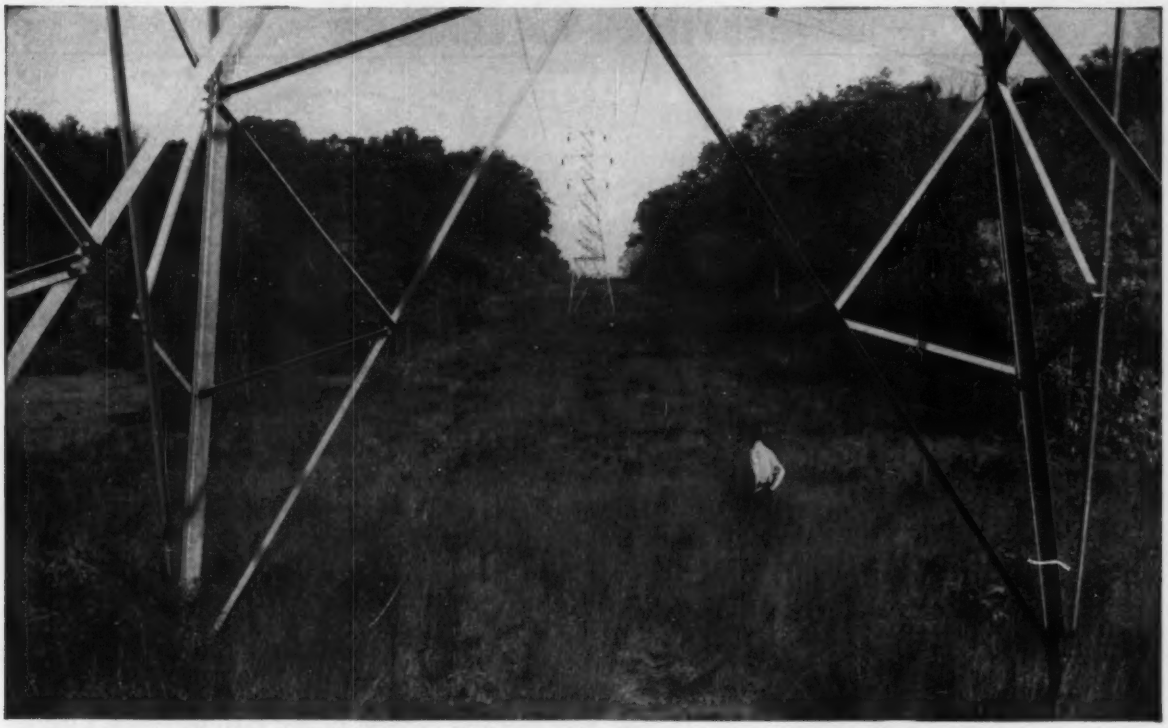
(*Continued from page* 96)

again. From an operational point of view, such unnecessary dumping of load is quite undesirable and can be avoided by connecting these loads to a vital bus, see Fig 6.

In the scheme of Fig 6 a battery is kept charged through an mg set consisting of an ac machine of the diverter pole type and a dc machine. The mg set is selected instead of a rectifier so that power can be transmitted in either direction. A diesel generator is also connected to this bus.

As soon as voltage drops measurably, the ac machine excitation is boosted to initiate power flow from battery to vital bus. The same signal can be used to initiate cranking of the diesel engine. As soon as the diesel generator is operating and synchronized, the mg set automatically returns to the battery charging setting. Because diesel-generator starting can be accomplished consistently in a fraction of a minute, perhaps 20 sec, the battery time rating need not be excessive.

In some cases, where the plant is more or less isolated from the remainder of the system, the diesel-generator unit can be rated to provide start-up power. Then a much longer list of loads must be considered, including turbine and reactor auxiliaries.



• Brush control with "Ammate" three growing seasons after application! This Rockland Power and Light right of way was originally 100% brush. Photograph taken October 1956.

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"Ammate" X kills roots of brush as well as tops . . . yet allows low-growing natural cover to come back.

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MEETINGS CALENDAR

JUNE

American Institute of Electrical Engineers—Summer General Meeting, Sheraton Mount Royal Hotel, Montreal, Quebec, June 24-28.

American Society of Heating and Air Conditioning Engineers—Semi-annual Meeting, Manoir Richelieu, Murray Bay, Quebec, June 24-26.

Electric Companies Public Information Program—West North Central Regional Group, Fort Des Moines, Des Moines, Iowa, June 25.

American Public Power Association—Hotel Biltmore, New York City, June 25-27.

National Machine Accountants Association—6th Annual Conference, Conrad Hilton Hotel, Chicago, Ill., June 26-28.

JULY

• **Edison Electric Institute**—Industrial Relations Committee, EEI Headquarters, New York City, July 18.

Southeastern Electric Exchange—Personnel Administration Section, John Marshall Hotel, Richmond, Va., July 25-26.

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

American Institute of Electrical Engineers—Pacific General Meeting, Pasco, Washington, Aug. 28-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pennsylvania, September 4-6; Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America—12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Edison Electric Institute—Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Sept. 23-25; Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Advertising Program—Copy Group Meeting, Detroit, Mich., Sept. 25.

Electric Companies Public Information Program—Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pennsylvania, October 2-3.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, Americus Hotel, Allentown, Pennsylvania, Oct. 21-23.

National Electronics Conference, Inc—Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Illinois, October 7-11.

Edison Electric Institute—Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 10-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Va., Oct. 23-24.

Interstate Power Club—Hotel Martinique, New York City, N. Y., October 14.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

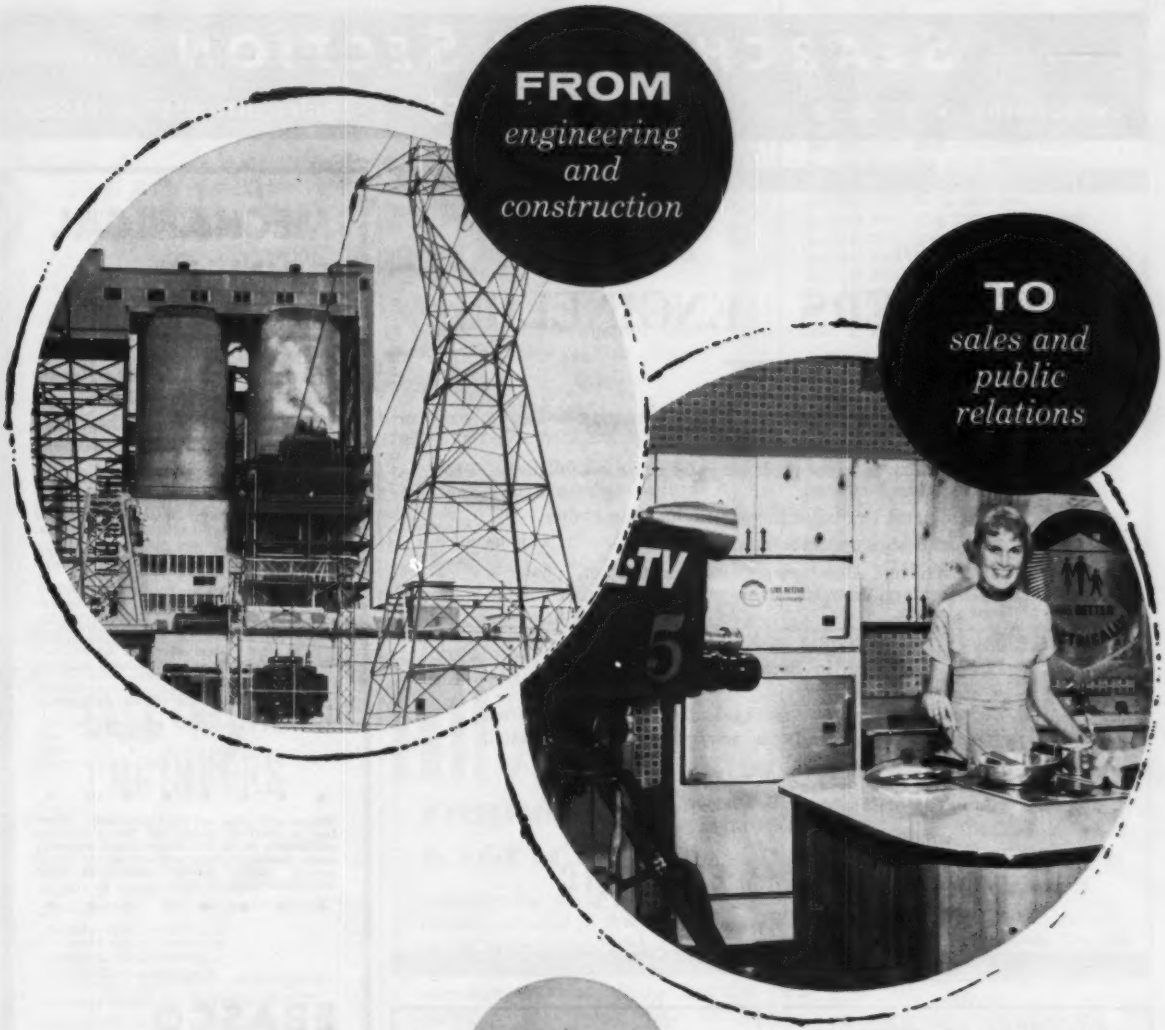
• **Edison Electric Institute**—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8.

• **Pacific Coast Electrical Association**—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

• **Institute of Radio Engineers**—Third Annual Instrumentation Conference, Atlanta Biltimore Hotel, Atlanta, Georgia., Nov. 11-13.

• **National Electrical Manufacturers Association**—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

• Additions this week.



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Advertising In This Issue

Allis-Chalmers Mfg. Co....4th Cover
6, 7, 63, 64, 77
Aluminum Co. of America....148, 149
Amp Inc. 144
American Brass Co. 139
American Crossarm & Conduit Co. 151
American Gas & Electric System. 196
American Mfg. Co., Inc. 150
Anaconda Wire & Cable Co. 68
69, 155

Baltimore & Ohio Railroad 70
Bell Telephone Laboratories 47
Bethlehem Steel Co. 145
Bishop Mfg. Corp. 154
Bristol Co., The 60
Brown Boveri Corp. 121
Buffalo Forge Co. 66, 67
Burndy Corp. 30, 31
Bussmann Mfg. Co. 152, 153

Cable Spinning Equipment Co. 122
Chance Co., A. B. 157, 211, 212
213, 214
Chase Brass & Copper Co. 72
Colorado Fuel & Iron Corp.,
Wickwire Spencer Steel Div. 42
Condenser Service & Engineering
Co., Inc. 142
Copperweld Steel Co. 38
Cornell-Dubilier Electric Corp.
124, 125
Crescent Tool Co. 40
Curtis Lighting, Inc. 156

Day-Brite Lighting Inc. 158
Diamond Power Specialty Corp. .. 194
Directory of Engineers 228
Dossert Mfg. Corp. 140
Duff-Norton Co. 159
Duncan Electric Co., Inc. 58
du Pont de Nemours & Co.,
Grasselli Chemicals Dept. 223

Eastern Specialty Co. 146
Eastman Chemical Products, Inc. 53
Ebasco Services Inc. 225
Electrical Engineers Equipment
Co. 161
Electro-Motive Div., General
Motors 78, 79
Engineers, Directory of 228
Everstick Anchor Co. 160
Exide Industrial Div., The Electric Storage Battery Co. .3rd Cover

Ferranti Ltd. 48
Fisher-Pierce Co., Inc. 206

General Cable Corp. 162
General Electric Co.
Apparatus Dept. ..113, 114, 115, 117
118, 119
Electronics Dept. 27
Graybar Electric Co., Inc. ...147, 190
Greenlee Tool Co. 163

Holan Corp., J. H. 143
Holophane Co., Inc. 39

Hotpoint Co. 15
Hubbard & Company 167
Hubbell, Inc., Harvey 164

I-T-E Circuit Breaker Co.,
R&IE Equipment Div. 11
12, 13, 14
Switchgear Div. 28, 29
Ilg Electric Ventilating Co. 166
Indiana Steel & Wire Co., Inc. ... 165
Ingalls Industries 197
Ingersoll-Rand 8
International Business Machines
Corp. 62
International Creosoting & Construction Co. 168

Johns-Manville 218

Kaiser Aluminum & Chemical
Sales, Inc. 170
Kearney Corp., James R. 217
Keasbey & Mattison Co. 203
Kerite Co., The 80
Kidde & Co., Inc., Walter 201
Klein & Sons, Mathias 169
Kyova Fiber Pipe Co. 137

Lapp Insulator Co., Inc. 49
Leach Company 171
Line Material Industries 33, 34
35, 36, 37

McCabe-Powers Auto Body Co. .. 61
Mercoid Corporation 172
Minneapolis-Honeywell Regulator
Co., Industrial Div. 141
Mobile Drilling, Inc. 222
Moloney Electric Co. 50, 51

National Telephone Supply Co. .. 173

O.Z. Electrical Mfg. Co., Inc. 176
Ohio Brass Co. 23, 24, 25, 26, 174
Okonite Co., The 4
Onan & Sons Inc., D. W. 220
Orangeburg Mfg. Co., Inc. 175

P. W. Industries, Inc. 202
Page Fence Ass'n. 220
Page & Hill, Inc. 10
Paranite Wire & Cable Div. Essex
Wire Corp. 76
Pennsylvania Transformer Div.,
McGraw-Edison Co. 129, 130
Permutit Company 56, 57
Pioneer Service & Engineering Co. 138
Pittsburgh Reflector Co. 177
Pittsburgh Standard Conduit Co. 135
Preformed Line Products Co. 133
Premax Products Div. Chisholm-
Ryder Co., Inc. 218

RT&E Corp. 41
Radio Corp. of America 65
Reliable Electric Co. 178

Remington Rand Div.
Sperry Rand Corp. 230
Republic Steel, Steel & Tubes Div. 183
Riley Stoker Corp. 16, 17

S&C Electric Co. 18
Salisbury & Co., W. H. 181
Sangamo Electric Co. 221
Searchlight Section 226, 227
Shaw-Perkins Mfg. Co. 222
Simplex Wire & Cable Co. 179
Sipe & Co., James B. 200
Southern States Equipment Corp. 59
Southwire Company 9
Sperti Faraday Inc. 180
Square D Company 182
Standard Transformer Co. 195
States Company 131
Subox Inc. 136

Templeton, Kenly & Co. 185
Texas Company ..... 2nd Cover
Thomas & Betts Co. 187
Thor Power Tool Co. 184
Tobe Deutschmann Corp. 73
Triangle Conduit & Cable Co., Inc. 186
Turner Electric Corp. 199

United States Rubber Co. 32
Uptegraff Mfg. Co., R. E. 74, 75

Victor Insulators Div.
I-T-E Circuit Breaker Co. 123

Weaver Co., J. A. 52
Westinghouse Electric Corp. .. 43, 44
45, 46, 54, 55, 219
Westinghouse Electric Corp.
Lamp Div. 204, 205
Weston Electrical Instrument
Corp. 188
Wheeler Reflector Co. 189
Whirlpool Corporation 126, 127
Wickwire Spencer Steel Div.,
Colorado Fuel & Iron Corp. 42
Worthington Corporation 192, 193

York-Hoover Corp. 71

Zinder & Associates 198

■

PROFESSIONAL SERVICES 228

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 226

EQUIPMENT
(Used or Surplus New)
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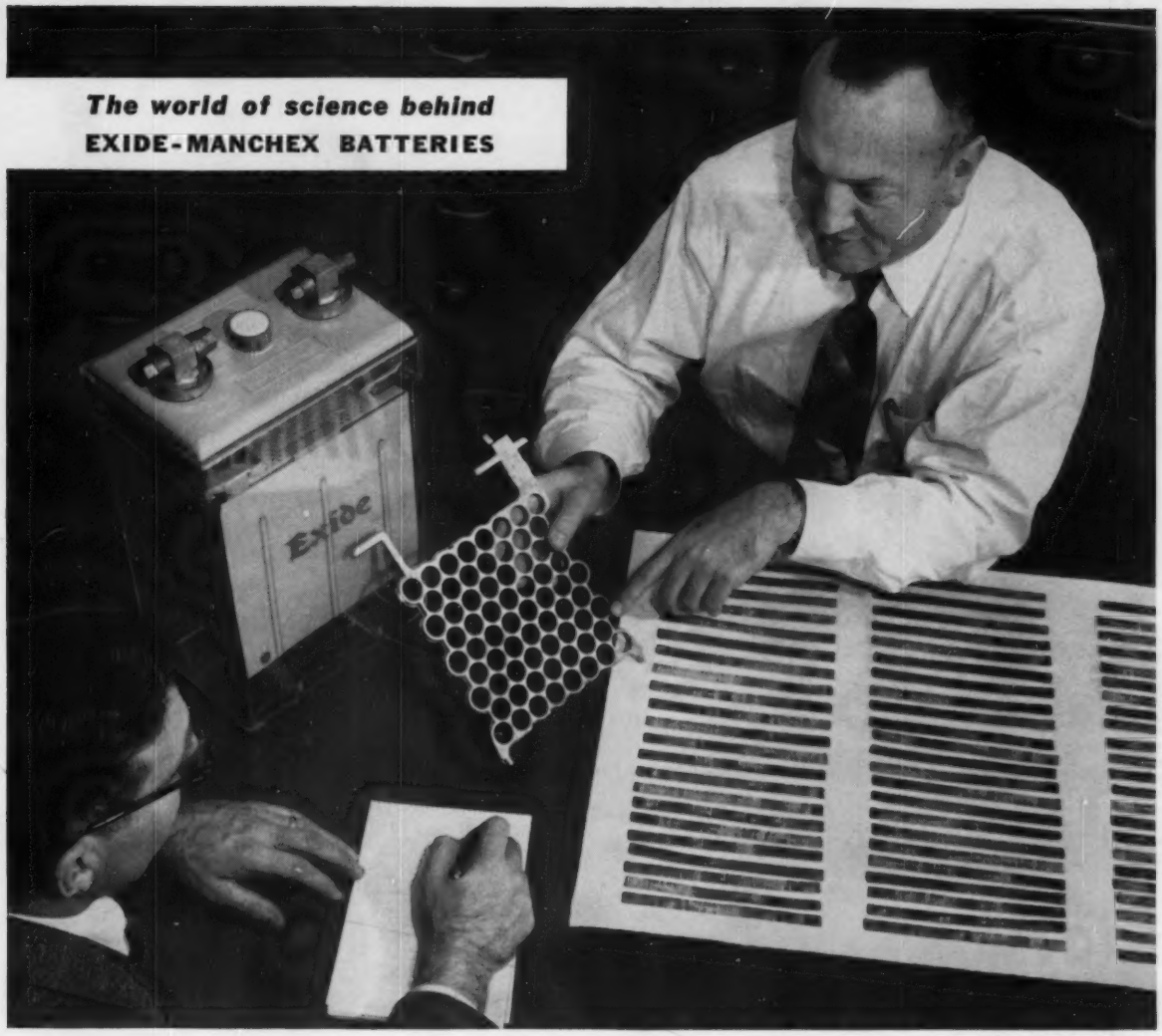

Being interviewed is Dr. H. J. Strauss, Chief Product Engineer

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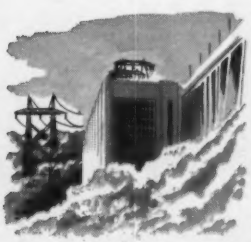

Strauss: Here we've taken the spiral lead buttons from a single Exide-Manchex positive plate and unrolled them on this table. This total area is actually five times the plate size.

Reporter: I see the strips are corrugated on one side. Is that to increase the surface area?

Strauss: Yes, and also to give the electrolyte free access into the interior of the spiral buttons.

Reporter: How does this feature affect battery performance?

Strauss: It means each part of the surface of the positive plate works easier to produce electricity. An Exide-Manchex can coast where many another battery is forced to strain. And the active material lasts years longer than it otherwise would.

Reporter: Is this construction available in any other battery?

Strauss: No, only in the Exide-Manchex.

Reporter: Obviously this is an important feature of the Exide-Manchex Batteries.

Strauss: Yes it is, but it's only one of many engineering details that contribute to their long life.

Note to battery users: Whenever you order batteries for floating service applications or the equipment that requires such batteries, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

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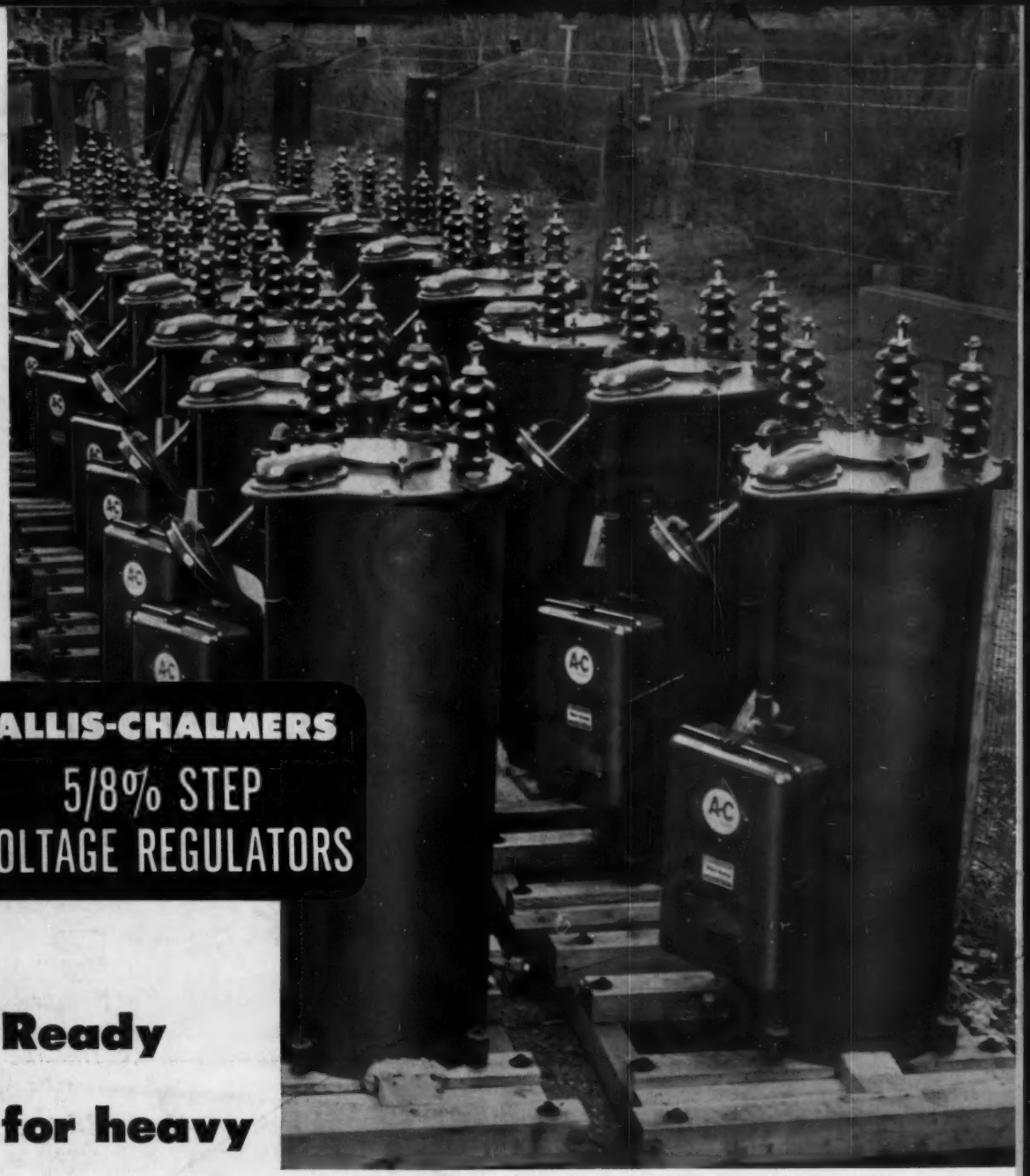

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